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Moving On

Andrew D. Auerbach, MD, MPH[1,2]*

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After seven years at the helm of the *Journal of Hospital Medicine*, I am both pleased to hand over the reins and sad to let them go. My time as Editor in Chief has been wonderful, challenging, and fulfilling.

When I began my tenure, JHM managed approximately 350 papers annually, and published 10 times per year. We had no social media presence, a developing editorial sense (and developing Editor in Chief), and a pool of hard-working and passionate Editors. As of this year, we have handled more than 700 papers and are publishing content monthly, online only, and online first. Our dedicated team is deeply passionate about making every paper better through interaction with the authors—whether we accept it for publication or not.

JHM has added a presence on Facebook and Twitter, launched a Twitter Journal Club as a regular offering (#JHMChat), added visual abstracts to our Tweets and Facebook postings, and researched how these novel approaches increase not only the Journal's social media presence but also its public face. Our efforts in social media were trendsetting in peer-reviewed literature, and the Editors who lead those efforts—Vineet Arora and Charlie Wray—are asked to consult for other journals regularly.

We launched two new series—*Choosing Wisely®:* Next Steps, and *Choosing Wisely®:* Things We Do For No Reason—with help from the ABIM Foundation and visionary Editors, Andy Masica, Ann Sheehy, and Lenny Feldman. These papers have pushed Hospitalists and Hospital Medicine to think carefully about the simple things we do every day, to think broadly about how to move past the initial 'low-hanging fruit' of value improvement, and point us towards policy and intervention approaches that are disruptive rather than incremental.

A special thank you to Som Mookherjee, Brian Harte, Dan Hunt, and Read Pierce who ably developed the Clinical Care Conundrums and Review series. They are assisted by teams of national correspondents and many contributors who've submitted work for those series.

I have been blessed by a team of more than a dozen Associate Editors who have ably, expeditiously, and collegially managed more than 2,000 papers. These Editors work out of a sense of altruism and commitment to Hospital Medicine and have made huge individual contributions to JHM through their reviewing expertise and ensuring that the editorial sense for JHM is as broad and innovative as our field.

Finally, I must thank my core team of Senior Deputy Editors who have shouldered the majority of editorial work, mentored Editors (including me) and Peer Reviewers, and provided strategic guidance.

How peer-reviewed journals are published is changing rapidly. Setting aside the questions of how we consume our medical literature and the transition from paper to digital, old financial models depending on subscriptions and advertising are either dying or evolving into something very different. The challenge is that the new model is very unclear and the old model based on ads and subscriptions is clearly nonviable but is the primary way to support the work of producing a journal. Moving from the current model to one based on clicks, views, or downloads will come down to who will derive benefit from those clicks/downloads, who will be willing to pay to read and learn from the work of authors, or who views that activity as being worthy enough advertise somewhere in that process or to monetize the data garnered from readers' activities. In addition, many journals, including JHM, are supported by professional societies. While professional societies have a goal to serve their members, the goal of the peer-reviewed journal is to independently and broadly represent the field. One must reflect the other, but space between the two will always be required.

The speed with which research takes place is too slow, and the process of getting evidence into print (much less adopted) is even slower. But, this too is changing; the role of peer review and the publication process is evolving. In order to speed the potential discovery of new innovations, prepublication repositories (such as BioRxViv) are gaining popularity; well-publicized scandals around peer reviewing rings[1] have not gone unnoticed, and have produced greater interest in using prepublication comments and online discussions as early forms of review. As a result, the disintermediation between scientist and 'evidence' is paralleling the disintermediation between events and messengers elsewhere. One need only review Twitter for a moment to get a sense for how crowdsourcing can lead to evidence (or news) generation for good or ill. I agree that while the end of journals (as we understand them now) is upon us, these are also opportunities for JHM as it enters its new phase and a place for leadership.[2]

I am proud of what we have done at JHM in the last seven years. We have grown substantially. We have innovated and provided great service to our authors and the field of Hospital Medicine. Our growth and forward-looking approaches to social media and our digital footprint put the journal on a great path towards adapting to the trends in Hospital Medicine research and peer-reviewed publishing. Our focus on being doctors who care for patients and our teams—not just doctors who care for hospitals—is supporting the field and our practice. I look forward to seeing where JHM goes next.

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Barriers to Early Hospital Discharge: A Cross-Sectional Study at Five Academic Hospitals

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BACKGROUND: Understanding the issues delaying hospital discharges may inform efforts to improve hospital throughput.

OBJECTIVE: This study was conducted to identify and determine the frequency of barriers contributing to delays in placing discharge orders.

DESIGN: This was a prospective, cross-sectional study. Physicians were surveyed at approximately 8:00 AM, 12:00 PM, and 3:00 PM and were asked to identify patients that were "definite" or "possible" discharges and to describe the specific barriers to writing discharge orders.

SETTING: This study was conducted at five hospitals in the United States.

PARTICIPANTS: The study participants were attending and housestaff physicians on general medicine services.

PRIMARY OUTCOMES AND MEASURES: Specific barriers to writing discharge orders were the primary outcomes; the secondary outcomes included discharge order time for high versus low team census, teaching versus nonteaching services, and rounding style.

RESULTS: Among 1,584 patient evaluations, the most common delays for patients identified as "definite" discharges (n = 949) were related to caring for other patients on the team or waiting to staff patients with attendings. The most common barriers for patients identified as "possible" discharges (n = 1,237) were awaiting patient improvement and for ancillary services to complete care. Discharge orders were written a median of 43-58 minutes earlier for patients on teams with a smaller versus larger census, on nonteaching versus teaching services, and when rounding on patients likely to be discharged first (all $P < .003$).

CONCLUSIONS: Discharge orders for patients ready for discharge are most commonly delayed because physicians are caring for other patients. Discharges of patients awaiting care completion are most commonly delayed because of imbalances between availability and demand for ancillary services. Team census, rounding style, and teaching teams affect discharge times. *Journal of Hospital Medicine* 2018;13:816-822. © 2018 Society of Hospital Medicine

Hospital discharges frequently occur in the afternoon or evening hours.[1-5] Late discharges can adversely affect patient flow throughout the hospital,[3,6-9] which, in turn, can result in delays in care,[10-16] more medication errors,[17] increased mortality,[18-20] longer lengths of stay,[20-22] higher costs,[23] and lower patient satisfaction.[24]

Various interventions have been employed in the attempts to find ways of moving discharge times to earlier in the day, including preparing the discharge paperwork and medications the previous night,[25] using checklists,[1,25] team huddles,[2] providing real-time feedback to unit staff,[1] and employing multidisciplinary teamwork.[1,2,6,25,26]

The purpose of this study was to identify and determine the relative frequency of barriers to writing discharge orders in the hopes of identifying issues that might be addressed by targeted interventions. We also assessed the effects of daily team census, patients being on teaching versus nonteaching services, and how daily rounds were structured at the time that the discharge orders were written.

METHODS

Study Design, Setting, and Participants

We conducted a prospective, cross-sectional survey of housestaff and attending physicians on general medicine teaching and nonteaching services from November 13, 2014, through

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Additional Supporting Information may be found in the online version of this article.

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TABLE 1. **Hospital, Provider, and Service Characteristics**

	DH	PSL	UCLA	LAC/USC	HMC	All sites
Hospital beds, N	525	477	520	600	413	2,535
Final discharge status, (%)						
Definite	384 (42)	137 (15)	130 (14)	114 (12)	153 (17)	918 (100)
Possible	73 (37)	16 (8)	13 (7)	80 (40)	17 (9)	199 (100)
No discharge	190 (41)	44 (9)	84 (18)	41 (9)	108 (23)	467 (100)
Total	647 (41)	197 (12)	227 (14)	235 (15)	278 (18)	1,584 (100)
Provider type surveyed, N (%)						
Attending	31 (33)	8 (18)	5 (11)	0	11 (30)	55 (22)
Residents	62 (67)	37 (82)	41 (89)	33 (100)	26 (70)	199 (78)
Service type, N (%)[a,b]						
Nonteaching	49 (34)	17 (24)	0	0	56 (54)	122 (26)
Teaching	97 (66)	54 (75)	84 (100)	72 (100)	48 (46)	355 (74)
Missing	0	1 (1)	0	0	0	1 (<1)
Rounding style, N (%)[a]						
Sickest patients first	59 (40)	12 (17)	23 (27)	55 (77)	11 (11)	160 (33)
Room-by-room	22 (15)	13 (18)	14 (17)	10 (14)	69 (66)	128 (27)
Newest patients first	10 (7)	35 (49)	25 (30)	1 (1)	7 (7)	78 (16)
Patients ready for discharge first	11 (8)	11 (15)	6 (7)	1 (1)	6(6)	35 (7)
All other rounding styles	1 (1)	1 (1)	16 (19)	5 (7)	11 (11)	34 (7)
Missing	43 (29)	0	0	0	0	43 (9)
Starting daily census, median (IQR)[a]	11 (9, 12)	10 (8, 11.5)	10 (7, 13)	14 (13, 15.0)	9 (7, 11)	11 (8, 13)
Discharge order time, median (IQR)	12:02 (11:00, 13:50)	11:06 (10:20, 12:04)	12:49 (11:16, 15:00)	12:29 (11:26, 14:10)	10:52 (8:52, 12:21)	11:50 (10:35, 13:45)
Discharge time, median (IQR)	14:57 (13:10, 16:30)	14:43 (12:38, 16:02)	14:46 (12:45, 17:00)	16:39 (14:20, 18:34)	14:22 (12:17, 16:35)	14:56 (13:05, 16:50)

[a]Data presented at the provider-evaluation level (ie, data collected each day a provider was called).

[b]Service type is missing from 3 evaluations for 3 patients by 1 provider.

Abbreviations: DH, Denver Health; HMC, Harborview Medical Center; IQR, interquartile range; LAC & USC, Los Angeles County and University of Southern California; PSL, Presbyterian St. Luke's Medical Center; UCLA, University of California Los Angeles.

May 31, 2016. The study was conducted at the following five hospitals: Denver Health Medical Center (DHMC) and Presbyterian/Saint Luke's Medical Center (PSL) in Denver, Colorado; Ronald Reagan University (UCLA) and Los Angeles County/University of Southern California Medical Center (LAC+USC) in Los Angeles, California; and Harborview Medical Center (HMC) in Seattle, Washington. The study was approved by the Colorado Multi-Institutional Review Board as well as by the review boards of the other participating sites.

Data Collection

The results of the focus groups composed of attending physicians at DHMC were used to develop our initial data collection template. Additional sites joining the study provided feedback, leading to modifications (Appendix 1).

Physicians were surveyed at three different time points on study days that were selected according to the convenience of the investigators. The sampling occurred only on weekdays and was done based on the investigators' availability. Investigators would attempt to survey as many teams as they were able to but, secondary to feasibility, not all teams could be surveyed on study days. The specific time points varied as a function of physician workflows but were standardized as much as possible to occur in the early morning, around noon, and mid-afternoon on weekdays. Physicians were contacted either in person or by telephone for verbal consent prior to administering the first survey. All general medicine teams were eligible. For teaching teams, the order of contact was resident, intern, and then attending based on which physician was available at the time of the survey and on which member of the team was thought to know the patients the best. For the nonteaching services, the attending physicians were contacted.

During the initial survey, the investigators assessed the provider role (ie, attending or housestaff), whether the service was a teaching or a nonteaching service, and the starting patient census on that service primarily based on interviewing the provider of record for the team and looking at team census lists. Physicians were asked about their rounding style (ie, sickest patients first, patients likely to be discharged first, room-by-room, most recently admitted patients first, patients on the team the

TABLE 2. **Physician-Perceived Barriers that Delayed Entering Discharge Orders on Patients Identified as Definite Discharges at any Time Point by All Service Types and Separated by Teaching Team or Nonteaching Team**[a]

	All Service Types			Teaching			Nonteaching		
Patients Identified as Definite Discharges	AM (N = 314)	Noon (N = 608)	PM[b] (N = 461)	AM N = 222	Noon N = 428	PM[b] N = 349	AM N = 92	Noon N = 177	PM[b] N = 111
Newly identified as definite discharge, N (%)	314 (100)	376 (62)	270 (59)	222 (100)	267 (62)	205 (59)	92 (100)	106 (60)	65 (59)
Patients identified as definite discharges without discharge orders	261 (83)	181 (30)	55 (12)	187 (84)	149 (35)	49 (14)	74 (80)	31 (18)	6 (5)
Caring for other patients									
Rounding on all patients first	**96 (37)**	**52 (29)**	0	**79 (42)**	**51 (34)**	0 (0)	**17 (23)**	1 (3)	0 (0)
Managing nonurgent issues with other patients	**45 (17)**	**41 (23)**	10 (18)	17 (9)	**34 (23)**	9 (18)	**28 (38)**	**7 (23)**	**1 (17)**
Managing urgent issues on other sick patients	21 (8)	23 (13)	5 (9)	10 (5)	16 (11)	5 (10)	**11 (15)**	**7 (23)**	0 (0)
Finishing other discharges	15 (6)	32 (18)	**17 (31)**	4 (2)	21 (14)	**13 (27)**	**11 (15)**	**11 (35)**	**4 (67)**
Teaching-related issues									
Needing to staff with attending	**82 (31)**	4 (2)	0	**81 (43)**	4 (3)	0 (0)	1 (1)	0 (0)	0 (0)
Other teaching activities	3 (1)	3 (2)	0	3 (2)	2 (1)	0 (0)	0 (0)	1 (3)	0 (0)
Finishing the discharge paperwork	35 (13)	**41 (23)**	**25 (45)**	**26 (14)**	**38 (26)**	**24 (49)**	9 (12)	2 (6)	**1 (17)**
Other issues									
Arranging follow-up	11 (4)	15 (8)	**14 (25)**	7 (4)	12 (8)	**14 (29)**	4 (5)	3 (10)	0 (0)
Waiting for consultant recommendations	17 (7)	13 (7)	5 (9)	16 (9)	12 (8)	5 (10)	1 (1)	1 (3)	0 (0)
Other	1 (<1)	12 (7)	2 (4)	1 (1)	12 (8)	2 (4)	0 (0)	0 (0)	0 (0)

Top three groups bolded for ease of comparison. Service type is missing from 3 evaluations for 3 patients by 1 provider.

[a]Patients could be identified as being definite discharges at multiple time points. More than one barrier could be identified per patient at any given survey time.

[b]PM timeframe represents only data from previously identified patient encounters at time points 1 and 2.

longest, or other) and then to identify all patients they thought would be definite discharges sometime during the day of the survey. Definite discharges were defined as patients whom the provider thought were either currently ready for discharge or who had only minor barriers that, if unresolved, would not prevent same-day discharge. They were asked if the discharge order had been entered and, if not, what was preventing them from doing so, if the discharge could in their opinion have occurred the day prior and, if so, why this did not occur. We also obtained the date and time of the admission and discharge orders, the actual discharge time, as well as the length of stay either through chart review (majority of sites) or from data warehouses (Denver Health and Presbyterian St. Lukes had length of stay data retrieved from their data warehouse).

Physicians were also asked to identify all patients whom they thought might possibly be discharged that day. Possible discharges were defined as patients with barriers to discharge that, if unresolved, would prevent same-day discharge. For each of these, the physicians were asked to list whatever issues needed to be resolved prior to placing the discharge order (Appendix 1).

The second survey was administered late morning on the same day, typically between 11 AM and 12 PM. In this survey, the physicians were asked to reassess the patients previously classified as definite and possible discharges for changes in status and/or barriers and to identify patients who had become definite or possible discharges since the earlier survey. Newly identified possible or definite discharges were evaluated in a similar manner as the initial survey.

The third survey was administered midafternoon, typically around 3 PM similar to the first two surveys, with the exception that the third survey did not attempt to identify new definite or possible discharges.

Sample Size

We stopped collecting data after obtaining a convenience sample of 5% of total discharges at each study site or on the study end date, which was May 31, 2016, whichever came first.

Data Analysis

Data were collected and managed using a secure, web-based application electronic data capture tool (REDCap), hosted at Denver Health. REDCap (Research Electronic Data Capture, Nashville, Tennessee) is designed to support data collection for research studies.[27] Data were then analyzed using SAS Enterprise Guide 5.1 (SAS Institute, Inc., Cary, North Carolina). All data entered into REDCap were reviewed by the principal investigator to ensure that data were not missing, and when there were missing data, a query was sent to verify if the data were retrievable. If retrievable, then the data would be entered. The volume of missing data that remained is described in our results.

TABLE 3. **Physician-Perceived Barriers to Discharge among Patients Identified as Possible Discharges by Teaching Team or Nonteaching Team[a]**

	All Service Types			Teaching			Nonteaching		
	AM (N = 1,181)	Noon (N = 693)	PM[b] (N = 194)	AM N = 891	Noon N = 537	PM[b] N = 161	AM N = 287	Noon N = 156	PM[b] N = 33
Newly identified as possible discharge, N (%)	1,181 (100)	55 (8)	2 (1)	891 (100)	45 (8)	2 (1)	287 (100)	10 (6)	0 (0)
Patients identified as possible discharges with barriers identified	1,181 (100)	682 (98)	188 (97)	891 (100)	527 (98)	155 (96)	287 (100)	155 (99)	33 (100)
Need to see clinical improvement	**288 (24)**	**133 (20)**	18 (10)	**190 (21)**	**84 (16)**	12 (8)	**96 (33)**	**49 (32)**	**6 (18)**
Social work	**280 (24)**	**188 (28)**	**48 (26)**	**243 (27)**	**169 (32)**	**47 (30)**	37 (13)	19 (12)	1 (3)
Consultant recommendations	217 (18)	137 (20)	45 (24)	164 (18)	108 (20)	36 (23)	53 (18)	29 (19)	9 (27)
Procedure	147 (12)	107 (16)	**44 (23)**	100 (11)	71 (13)	**29 (19)**	**47 (16)**	**36 (23)**	**15 (45)**
Labs/Radiology	118 (10)	74 (11)	21 (11)	92 (10)	59 (11)	17 (11)	26 (9)	15 (10)	4 (12)
PT/OT	95 (8)	69 (10)	12 (6)	62 (7)	50 (9)	10 (6)	33 (12)	19 (12)	2 (6)
Other (eg, arranging home oxygen)	18 (2)	13 (2)	6 (3)	14 (2)	10 (2)	5 (3)	4 (1)	3 (2)	1 (3)
Have not yet evaluated or staffed the patients	175 (15)	35 (5)	12 (6)	141 (16)	25 (5)	9 (6)	34 (12)	10 (6)	3 (9)
Patient or family issues	41 (3)	34 (5)	2 (1)	36 (4)	30 (6)	2 (1)	5 (2)	4 (3)	0 (0)
Missing	0	11 (2)	6 (3)	0	10 (2)	6 (4)	0	1 (1)	0

Top three groups bolded for ease of comparison. Service type is missing from three evaluations for three patients by one provider.

[a]Patients could be identified as being a possible discharge at multiple time points. More than one barrier could be identified per patient at any given survey time.

[b]PM timeframe represents data from previously identified patient encounters at time points 1 and 2.

Continuous variables were described using means and standard deviations (SD) or medians and interquartile ranges (IQR) based on tests of normality. Differences in the time that the discharge orders were placed in the electronic medical record according to morning patient census, teaching versus nonteaching service, and rounding style were compared using the Wilcoxon rank sum test. Linear regression was used to evaluate the effect of patient census on discharge order time. $P < .05$ was considered as significant.

RESULTS

We conducted 1,584 patient evaluations through surveys of 254 physicians over 156 days. Given surveys coincided with the existing work we had full participation (ie, 100% participation) and no dropout during the study days. Median (IQR) survey time points were 8:30 AM (7:51 AM, 9:12 AM), 11:45 AM (11:30 AM, 12:17 PM), and 3:20 PM (3:00 PM, 4:06 PM).

The characteristics of the five hospitals participating in the study, the patients' final discharge status, the types of physicians surveyed, the services on which they were working, the rounding styles employed, and the median starting daily census are summarized in Table 1. The majority of the physicians surveyed were housestaff working on teaching services, and only a small minority structured rounds such that patients ready for discharge were seen first.

Over the course of the three surveys, 949 patients were identified as being definite discharges at any time point, and the large majority of these (863, 91%) were discharged on the day of the survey. The median (IQR) time that the discharge orders were written was 11:50 AM (10:35 AM, 1:45 PM).

During the initial morning survey, 314 patients were identified as being definite discharges for that day (representing approximately 6% of the total number of patients being cared for, or 33% of the patients identified as definite discharges throughout the day). Of these, the physicians thought that 44 (<1% of the total number of patients being cared for on the services) could have been discharged on the previous day. The most frequent reasons cited for why these patients were not discharged on the previous day were "Patient did not want to leave" (n = 15, 34%), "Too late in the day" (n = 10, 23%), and "No ride" (n = 9, 20%). The remaining 10 patients (23%) had a variety of reasons related to system or social issues (ie, shelter not available, miscommunication).

At the morning time point, the most common barriers to discharge identified were that the physicians had not finished rounding on their team of patients and that the housestaff needed to staff their patients with their attending. At noon, caring for other patients and tending to the discharge processes were most commonly cited, and in the afternoon, the most common barriers were that the physicians were in the process of completing the discharge paperwork for those patients or were discharging other patients (Table 2). When comparing barriers on teaching to nonteaching teams, a higher proportion of teaching teams were still rounding on all patients and were working on discharge paperwork at the second survey. Barriers cited by sites were similar; however, the frequency at which the barriers were mentioned varied (data not shown).

The physicians identified 1,237 patients at any time point as being possible discharges during the day of the survey and these had a mean (±SD) of 1.3 (±0.5) barriers cited for why

TABLE 4. **Effect of Starting Census, Rounding Style, and Teaching versus Nonteaching Service on Discharge Order Time and Discharge Time**

	Patients with Discharge Orders Placed (N = 863)	Median Discharge Order Time, Hour (IQR)	*P* Value	Patients Discharged from Hospital (N = 822)[a]	Median Discharge Time, Hour (IQR)	*P* Value
Starting census, N (%)			.0003			.0057
0-11 patients	498 (58)	11:31 (10:20, 13:31)		459 (56)	14:47 (12:45; 16:37)	
12 and greater	365 (42)	12:14 (10:57, 14:01)		363 (44)	15:14 (13:15, 17:03)	
Rounding style, N (%)			.0026			.0010
Discharges first	82 (10	11:07 (9:40, 13:15)		80 (10)	14:00 (12:11, 15:32)	
All other styles	671 (78)	11:55 (10:37, 13:48)		632 (77)	15:00 (13:07, 16:57)	
Missing[b]	110 (13)	12:03 (11:01, 13:47)		110 (13)	15:05 (13:30, 16:51)	
Teaching, N (%)			<.0001			<.0001
Yes	608 (71)	12:04 (11:00, 14:00)		567 (69)	15:06 (13:20, 17:03)	
No	252 (29)	11:06 (9:32, 13:03)		252 (31)	14:29 (12:27, 16:05)	
Missing[b]	3 (<1)	11:22 (11:04, 13:23)		3 (<1)	17:30 (16:20, 18:00)	

[a]41 (5%) of 863 patients with a discharge order placed were missing the date/time stamp for discharge.

[b]Missing data at the patient level.

these patients were possible rather than definite discharges. The most common were that clinical improvement was needed, one or more pending issues related to their care needed to be resolved, and/or awaiting pending test results. The need to see clinical improvement generally decreased throughout the day as did the need to staff patients with an attending physician, but barriers related to consultant recommendations or completing procedures increased (Table 3). Of the 1,237 patients ever identified as possible discharges, 594 (48%) became a definite discharge by the third call and 444 (36%) became a no discharge as their final status. As with definite discharges, barriers cited by sites were similar; however, the frequency at which the barriers were mentioned varied.

Among the 949 and 1,237 patients who were ever identified as definite or possible discharges, respectively, at any time point during the study day, 28 (3%) and 444 (36%), respectively, had their discharge status changed to no discharge, most commonly because their clinical condition either worsened or expected improvements did not occur or that barriers pertaining to social work, physical therapy, or occupational therapy were not resolved.

The median time that the discharge orders were entered into the electronic medical record was 43 minutes earlier if patients were on teams with a lower versus a higher starting census (P = .0003), 48 minutes earlier if they were seen by physicians whose rounding style was to see patients first who potentially could be discharged (P = .0026), and 58 minutes earlier if they were on nonteaching versus teaching services (P < .0001; Table 4). For every one-person increase in census, the discharge order time increased by 6 minutes (β = 5.6, SE = 1.6, P = .0003).

DISCUSSION

The important findings of this study are that (1) the large majority of issues thought to delay discharging patients identified as definite discharges were related to physicians caring for other patients on their team, (2) although 91% of patients ever identified as being definite discharges were discharged on the day of the survey, only 48% of those identified as possible discharges became definite discharges by the afternoon time point, largely because the anticipated clinical improvement did not occur or care being provided by ancillary services had not been completed, and (3) discharge orders on patients identified as definite discharges were written on average 50 minutes earlier by physicians on teams with a smaller starting patient census, on nonteaching services, or when the rounding style was to see patients ready for discharges first.

Previous research has reported that physician-perceived barriers to discharge were extrinsic to providers and even extrinsic to the hospital setting (eg, awaiting subacute nursing placement and transportation).[28,29] However, many of the barriers that we identified were related directly to the providers' workload and rounding styles and whether the patients were on teaching versus nonteaching services. We also found that delays in the ability of hospital services to complete care also contributed to delayed discharges.

Our observational data suggest that delays resulting from car-

ing for other patients might be reduced by changing rounding styles such that patients ready for discharge are seen first and are discharged prior to seeing other patients on the team, as previously reported by Beck et al.[30] Intuitively, this would seem to be a straightforward way of freeing up beds earlier in the day, but such a change will, of necessity, lead to delaying care for other patients, which, in turn, could increase their length of stays. Durvasula et al. suggested that discharges could be moved to earlier in the day by completing orders and paperwork the day prior to discharge.[25] Such an approach might be effective on an Obstetrical or elective Orthopedic service on which patients predictably are hospitalized for a fixed number of days (or even hours) but may be less relevant to patients on internal medicine services where lengths of stay are less predictable. Interventions to improve discharge times have resulted in earlier discharge times in some studies,[2,4] but the overall length of stay either did not decrease[25] or increased[31] in others. Werthheimer et al.[1] did find earlier discharge times, but other interventions also occurred during the study period (eg, extending social work services to include weekends).[1,32]

We found that discharge times were approximately 50 minutes earlier on teams with a smaller starting census, on nonteaching compared with teaching services, or when the attending's rounding style was to see patients ready for discharges first. Although 50 minutes may seem like a small change in discharge time, Khanna et al.[33] found that when discharges occur even 1 hour earlier, hospital overcrowding is reduced. To have a lower team census would require having more teams and more providers to staff these teams, raising cost-effectiveness concerns. Moving to more nonteaching services could represent a conflict with respect to one of the missions of teaching hospitals and raises a cost-benefit issue as several teaching hospitals receive substantial funding in support of their teaching activities and housestaff would have to be replaced with more expensive providers.

Delays attributable to ancillary services indicate imbalances between demand and availability of these services. Inappropriate demand and inefficiencies could be reduced by systems redesign, but in at least some instances, additional resources will be needed to add staff, increase space, or add additional equipment.

Our study has several limitations. First, we surveyed only physicians working in university-affiliated hospitals, and three of these were public safety-net hospitals. Accordingly, our results may not be generalizable to different patient populations. Second, we surveyed only physicians, and Minichiello et al.[29] found that barriers to discharge perceived by physicians were different from those of other staff. Third, our data were observational and were collected only on weekdays. Fourth, we did not differentiate interns from residents, and thus, potentially the level of training could have affected these results. Similarly, the decision for a "possible" and a "definite" discharge is likely dependent on the knowledge base of the participant, such that less experienced participants may have had differing perspectives than someone with more experience. Fifth, the sites did vary based on the infrastructure and support but also had several similarities. All sites had social work and case management involved in care, although at some sites, they were assigned according to team and at others according to geographic location. Similarly, rounding times varied. Most of the services surveyed did not utilize advanced practice providers (the exception was the nonteaching services at Denver Health, and their presence was variable). These differences in staffing models could also have affected these results.

Our study also has a number of strengths. First, we assessed the barriers at five different hospitals. Second, we collected real-time data related to specific barriers at multiple time points throughout the day, allowing us to assess the dynamic nature of identifying patients as being ready or nearly ready for discharge. Third, we assessed the perceptions of barriers to discharge from physicians working on teaching as well as nonteaching services and from physicians utilizing a variety of rounding styles. Fourth, we had a very high participation rate (100%), probably due to the fact that our study was strategically aligned with participants' daily work activities.

In conclusion, we found two distinct categories of issues that physicians perceived as most commonly delaying writing discharge orders on their patients. The first pertained to patients thought to definitely be ready for discharge and was related to the physicians having to care for other patients on their team. The second pertained to patients identified as possibly ready for discharge and was related to the need for care to be completed by a variety of ancillary services. Addressing each of these barriers would require different interventions and a need to weigh the potential improvements that could be achieved against the increased costs and/or delays in care for other patients that may result.

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Predictors of Clinically Significant Echocardiography Findings in Older Adults with Syncope: A Secondary Analysis

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BACKGROUND: Syncope is a common reason for visiting the emergency department (ED) and is associated with significant healthcare resource utilization.

OBJECTIVE: To develop a risk-stratification tool for clinically significant findings on echocardiography among older adults presenting to the ED with syncope or near-syncope.

DESIGN: Prospective, observational cohort study from April 2013 to September 2016

SETTING: Eleven EDs in the United States

PATIENTS: We enrolled adults (≥60 years) who presented to the ED with syncope or near-syncope who underwent transthoracic echocardiography (TTE).

MEASUREMENTS: The primary outcome was a clinically significant finding on TTE. Clinical, electrocardiogram, and laboratory variables were also collected. Multivariable logistic regression analysis was used to identify predictors of significant findings on echocardiography.

RESULTS: A total of 3,686 patients were enrolled. Of these, 995 (27%) received echocardiography, and 215 (22%) had a significant finding on echocardiography. Regression analysis identified five predictors of significant findings: (1) history of congestive heart failure, (2) history of coronary artery disease, (3) abnormal electrocardiogram, (4) high-sensitivity troponin-T >14 pg/mL, and 5) N-terminal pro B-type natriuretic peptide >125 pg/mL. These five variables make up the ROMEO (Risk Of Major Echocardiography findings in Older adults with syncope) criteria. The sensitivity of a ROMEO score of zero for excluding significant findings on echocardiography was 99.5% (95% CI: 97.4%-99.9%) with a specificity of 15.4% (95% CI: 13.0%-18.1%).

CONCLUSIONS: If validated, this risk-stratification tool could help clinicians determine which syncope patients are at very low risk of having clinically significant findings on echocardiography.

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Syncope, defined as a transient loss of consciousness and postural tone followed by complete, spontaneous return to neurological baseline, accounts for over one million (or approximately 1%) of all emergency department (ED) visits per year in the United States (US).[1 2] Given the breadth of etiologies for syncope, including certain life-threatening conditions, extensive diagnostic evaluation and hospitalization for this complaint is common.[3-7] The estimated costs of syncope-related hospitalizations are over $2.4 billion annually in the US.[8]

The 2011 American College of Cardiology Foundation appropriate use criteria for echocardiography state that syncope is an appropriate indication for transthoracic echocardiography (TTE) even when there are no other symptoms or signs of cardiovascular disease.[9] This broad recommendation may be appropriate since a finding of severe valvular disease would generally merit consultation with a cardiothoracic surgeon to assess the potential for surgical intervention.[10] However, routine use of echocardiogram in all syncope patients could result in increased healthcare costs, patient discomfort, and incidental findings of unclear significance, while rarely changing diagnosis or management.[11,12]

In an attempt to reduce potentially unnecessary TTE testing, several studies have tried to identify patients at very low risk of structural heart disease.[13-17] These investigations suggest that TTE is not indicated in syncope patients with a normal ECG and a normal cardiac exam. However, this literature is limited by retrospective study design and/or small sample sizes. The 2017 American Heart Association/American College of Cardiology/Heart Rhythm Society syncope guidelines recommend TTE for a patient in whom structural heart disease is suspected, but they are not explicit about how to make this determination. [18] Thus, it is still unclear which syncope patients require TTE since a standardized approach to assessing risk of clinically significant findings on TTE has not yet been rigorously developed.

The objective of this study was to develop a risk-stratification tool to identify older adults at very low risk of having a major, clinically significant finding on rest TTE after presenting to the ED with syncope or near-syncope. Using clinical, ECG, and cardiac biomarker data, we created the ROMEO (Risk Of Major Echocardiography findings in Older adults with syncope) score to help optimize resource utilization for syncope.

METHODS

Study Design and Setting

We conducted a large, multicenter, prospective, observational cohort study of older adults who presented to an ED with syncope or near-syncope (ClinicalTrials.gov identifier: NCT01802398). The study was approved by the institutional review boards at all sites and written informed consent was obtained from all participating subjects. The study was conducted at 11 academic EDs across the US (Appendix Table 1).

Study Population

Patient inclusion criteria for eligibility were age ≥60 years with a complaint of syncope or near-syncope. Syncope was defined as transient loss of consciousness, associated with postural loss of tone, with immediate, spontaneous, and complete recovery. Near syncope was defined as the sensation of imminent loss of consciousness. Patients were excluded if their symptoms were thought to be due to intoxication, seizure, stroke, head trauma, or hypoglycemia. Additional exclusion criteria were the need for medical intervention to restore consciousness (eg, defibrillation), new or worsening confusion, and inability to obtain informed consent from the patient or a legally authorized representative.

This analysis included only patients who received a TTE during the index visit (either in the ED, observation unit, or while admitted to the hospital). This dataset was also used for other analyses addressing questions relevant to the ED management of syncope.

Measurements

All patients underwent a standardized history, physical examination, laboratory, and 12-lead ECG testing. Trained research assistants (RA) directly queried patients about symptoms associated with the syncopal episode. Data on the patient's past medical history, medications, and physical examination findings were collected prospectively from treating providers.

Research staff obtained blood samples for testing at a core laboratory (University of Rochester, Rochester, NY). Two assays were performed using the Roche Elecsys platform: N-terminal pro B-type natriuretic peptide (NT-proBNP) and the 5th generation high-sensitivity cardiac troponin T (hs-TnT). NT-proBNP was classified as abnormal above a cutoff of 125 pg/mL. Hs-TnT was classified as abnormal above the 99th percentile for a reference population (14 pg/mL). Although hs-TnT was not approved by the U.S. Food and Drug Administration (FDA) at the time of the study, we anticipated that this assay would receive approval and be integrated into future standard of care (FDA approval was granted in January 2017). Rest TTEs were ordered at the discretion of the treating providers.

Outcome Measures

The primary outcome for this secondary analysis was a major, clinically significant finding on TTE.[13,14,16,19] These included severe aortic stenosis (<1 cm^2), severe mitral stenosis, severe aortic/mitral regurgitation, reduced ejection fraction (defined either quantitatively as less than 45% or qualitatively as "severe left ventricular dysfunction"), hypertrophic cardiomyopathy with outflow tract obstruction, severe pulmonary hypertension, right ventricular dysfunction/strain, large pericardial effusion, atrial myxoma, or regional wall motion abnormalities.

All echocardiogram reports were independently reviewed by two research physicians. Discrepant reviews were resolved by the research physicians and two of the study investigators (BS, CB). Of note, all the TTEs obtained were formal echocardiographic studies, not bedside ultrasonography performed by the emergency physician.

Candidate Predictors

Potential candidate predictors were identified through a prior expert panel process.[20,21] Candidate predictors included age, sex, abnormal heart sounds, exertional syncope, shortness of breath, chest pain, near-syncope, family history of sudden cardiac death, high (>180 mm Hg) or low (<90 mm Hg) systolic blood pressure, abnormal ECG, elevated hs-TnT, elevated NT-proBNP, and history of the following: hypertension, cardiac dysrhythmia, renal failure, diabetes, congestive heart failure (CHF), and coronary artery disease (CAD).

The first obtained ECG was abstracted by one of five research study physicians blinded to all clinical data. Research study physicians demonstrated high interrater reliability (kappa > 0.80) in distinguishing normal from abnormal ECGs in a training set of 50 ECGs. Abnormal ECG interpretations included

nonsinus rhythms (including paced rhythms), multiple premature ventricular complexes, sinus bradycardias (≤40 bpm), ventricular hypertrophies, short PR segment intervals (<100 milliseconds [ms]), axis deviations, first degree blocks (>200 ms), complete bundle branch blocks, Brugada patterns, Wolff-Parkinson-White patterns, abnormal QRS duration (>120 ms) or abnormal QTc prolongations (>450 ms), and Q/ST/T segment abnormalities suggestive of acute or chronic ischemia.

Statistical Analysis

We calculated descriptive statistics for each predictor variable, stratified by the presence or absence of TTE findings. Chi-square and *t*-tests were used to test associations between categorical or continuous variables and TTE findings using a significance level of 0.05 and two-sided hypothesis testing. To identify a robust set of predictors of the primary outcome, we used multivariate logistic regression with the LASSO (Least Absolute Shrinkage and Selection Operator) to fit a parsimonious model.[22] The LASSO selects variables and shrinks the associated coefficients to avoid overfitting.[23-25] We then used a bootstrap to generate confidence intervals for coefficient estimates. Cases with missing echocardiography reports were excluded from the analysis. Bootstrap results were summarized as the percentage of bootstrap iterations in which each variable's coefficient was (1) chosen and negative, (2) shrunk to zero, or (3) chosen and positive.

We assessed different weighting schemes to generate a risk score from significant variables identified by regression modeling. These included weighting by regression coefficients rounded to the nearest integer and simple summation of the presence or absence of each variable.

Based on these results, a predictive score was developed to risk stratify patients on their probability of major, clinically significant findings on TTE. The sensitivity and specificity of a score of zero to predict findings on TTE was calculated. For confidence intervals, we used Wilson's method for binomial confidence intervals.[26] The receiver operating characteristic (ROC) curve and its associated area under the curve (AUC) were calculated, and a confidence interval for the AUC was obtained through bootstrap resampling with 2,000 iterations. As part of our sensitivity analyses, we also calculated the ROC curve and AUC after excluding the patients with a known history of CHF and significant finding on TTE. Data analyses were performed in R.[27] Two sensitivity analyses were performed: (1) we used multiple imputation to impute 1,000 complete data sets and then used the same LASSO methodology as with the complete data to assess whether incorporating missing data changed the results; and (2) we simulated a conventional troponin assay by raising the positive threshold for hs-TnT to >30 pg/mL (corresponding to the limit of detection for conventional troponin).[28]

RESULTS

Characteristics of Study Subjects

Patient screening occurred from April 2013 to September 2016. There were 6,930 patients who met eligibility criteria, of whom 3,686 (53%) consented and enrolled in the study (Figure 1). Of these, 995 (27%) received TTE. The mean age of patients receiving TTE was 74 years; 55% were male. Characteristics of patients obtaining and not obtaining TTE are presented in Appendix Table 2. Patients who received TTE were more likely to be older, have abnormal heart sounds, abnormal EKGs, elevated hs-TnT, elevated NT-proBNP, and have a history of CHF. Of the 995 subjects receiving TTE, 215 (21.6%) had a major, clinically significant finding.

Main Results

Univariate analysis identified 14 variables significantly associated with major findings on TTE. These included male gender, shortness of breath, abnormal heart sounds, history of renal failure, diabetes, CHF, CAD, abnormal ECG, and elevated cardiac biomarkers, among others (Table 1). The most common major finding on TTE was regional wall motion abnormality, followed by reduced left ventricular ejection fraction (Table 2). Of the 995 patients who received TTE, 20 (2%) were discharged directly from the ED, 444 (45%) were observed, and 531 (53%) were admitted. On average, patients who received TTE had a longer length of stay than did those that did not (3.4 days vs 1.9 days).

LASSO multivariable logistic regression produced five predictors associated with major findings on TTE: (1) history of CHF, (2) history of CAD, (3) abnormal ECG, 4) hs-TnT above 14 pg/mL, and 5) NT-proBNP above 125 pg/mL (Table 3).

These five high-risk clinical variables retained their importance after multivariate analysis and form the ROMEO score. The sensitivity and specificity of a ROMEO score of zero for excluding major findings on TTE was 99.5% (95% CI: 97.4%-99.9%) and 15.4% (95% CI: 13.0%-18.1%), respectively. Patients with a ROMEO score of 0 were at very low risk of having a major finding on TTE: 0.8% (95% CI: 0.02%-4.5%; Appendix Table 3). Only one out of 121 patients with none of the ROMEO criteria was found to have a major finding on TTE (regional wall motion abnormality). Patients with a score of one or more were at moderate-to-high risk of having a major finding (7.3% to 55.6%).

There was a linear relationship between the ROMEO score and probability of major findings on TTE (Appendix Figure 1). The AUC was 0.77 (95% CI = 0.72-0.79) indicating good accuracy of the combination of the five high-risk clinical variables to predict major findings on TTE (Appendix Figure 2). After excluding the 72 patients with known CHF and significant findings on TTE, the AUC was similar: 0.73 (95% CI: 0.69-0.77). There were 139 patients with at least one missing variable (14%; Appendix Table 4). A multiple imputation sensitivity analysis identified the same five high-risk clinical variables in 85% of imputations.

There were 253 patients with high-sensitivity troponin levels between 15 and 30 pg/mL (inclusive). Using a higher hs-TnT threshold (>30 pg/mL) to simulate a conventional troponin assay again identified the same five high-risk variables along with shortness of breath as a potential sixth variable though with an odds ratio approaching unity (Appendix Table 5). The ROMEO score would have missed two additional patients with major findings if the troponin cutoff were raised to 30 pg/mL from 14 pg/mL, ie, it would have identified 212/215 (98.6%) of the major findings rather than 214/215 (99.5%).

TABLE 1. **Univariate Analysis: Clinical Variables Associated with Major Findings on Echocardiography after Syncope**

Clinical Variable	No. (%)	Normal/minor findings on TTE (N=780)	Major Findings on TTE (N=215)	Odds Ratio	95% CI
Age, mean (SD)	74.1 (9.1)	73.9 (8.9)	74.8 (9.9)	1.01	(0.99, 1.03)
Male gender	547 (55)	409 (52)	138 (64)	1.63	(1.19, 2.22)
Race					
White	813 (82)	639 (82)	174 (81)	ref	ref
Black	146 (15)	110 (14)	36 (17)	1.20	(0.84, 1.81)
Other	33 (3)	28 (4)	5 (2)	0.66	(0.25, 1.72)
Shortness of breath	213 (21)	147 (19)	66 (31)	1.90	(1.35, 2.68)
Exertional syncope	194 (19)	145 (19)	49 (23)	1.29	(0.89, 1.86)
Abnormal heart sounds	133 (13)	87 (11)	46 (21)	2.15	(1.45, 3.19)
Chest discomfort	86 (9)	63 (8)	23 (11)	1.41	(0.85, 2.34)
Near syncope	296 (30)	216 (28)	80 (37)	1.55	(1.13, 2.13)
SBP > 180 mm Hg	10 (1)	7 (1)	3 (1)	1.56	(0.40, 6.08)
SBP < 90 mm Hg	42 (4)	35 (4)	7 (3)	0.72	(0.31, 1.64)
History of SCD in 1st degree relative	95 (10)	64 (8)	31 (14)	1.89	(1.19, 2.99)
History of hypertension	683 (69)	520 (67)	163 (76)	1.56	(1.10, 2.20)
History of dysrhythmia	250 (25)	173 (22)	77 (36)	1.95	(1.41, 2.70)
History of renal failure	119 (12)	78 (10)	41 (19)	2.11	(1.40, 3.20)
History of diabetes	266 (27)	191 (24)	75 (35)	1.65	(1.19, 2.28)
History of CHF	153 (15)	81 (10)	72 (33)	4.33	(3.01, 6.24)
History of CAD	304 (31)	193 (25)	111 (52)	3.24	(2.37, 4.42)
Abnormal ECG	611 (61)	437 (56)	174 (81)	4.08	(2.74, 6.07)
History of reduced EF	35 (4)	13 (2)	22 (10)	6.71	(3.32, 13.56)
History of structural heart disease	159 (16)	101 (13)	58 (27)	2.48	(1.72, 3.57)
Hs-TnT (>14 pg/ml)	479 (48)	330 (42)	149 (69)	3.6	(2.53, 5.14)
NT-proBNP (>125 pg/ml)	698 (70)	509 (65)	189 (88)	5.82	(3.36, 10.06)

Abbreviations: CAD, Coronary Artery Disease; CHF, Congestive Heart Failure; CI: Confidence Interval. ECG, Electrocardiogram; EF, Ejection Fraction; Hs-TnT, high-sensitivity cardiac troponin T; mm Hg, millimeters of mercury; NT-proBNP: N-terminal pro B-type natriuretic peptide; SBP, Systolic Blood Pressure; SCD, Sudden Cardiac Death; SD, Standard Deviation; TTE, Transthoracic Echocardiography.

Those with a race of "White" were used as the reference standard to which "Black" or "Other" were compared with.

DISCUSSION

Older adults with syncope often present to the ED and undergo a variety of diagnostic tests, including TTE, and a significant proportion are admitted to the hospital.[2] There is currently no standardized, evidence-based approach to guide TTE ordering for these patients. Using a large, prospective dataset of syncope patients, we sought to develop a risk-stratification tool to help clinicians identify which syncope patients would be at very low risk for clinically significant findings on TTE. We found that in the absence of these five high-risk clinical variables, the rate of significant findings on TTE in our sample was less than 1%. All five high-risk variables included in the tool remained predictive in our sensitivity analyses, speaking to the robustness of our model.

Other retrospective, and smaller prospective, studies have identified a combination of low-risk criteria including: a normal ECG alone,[15] a normal physical exam and normal ECG,[14,17] a negative cardiac history and normal ECG.[16] Han et al. performed a chart review of 241 patients presenting to the ED with syncope and identified three risk factors for abnormal TTE findings using multiple logistic regression: age, abnormal ECG, and BNP greater than 100 pg/mL.[13] While these studies' results are generally consistent with ours, the retrospective nature and small sample size of these studies limit the generalizability of these results. Thus, using a large, multicenter prospective dataset, we derived a clinical decision instrument (the ROMEO

TABLE 2. **List of Major, Clinically Significant Echocardiogram Findings, n = 215**

Major Finding	Frequency, No. (%)
Regional wall motion abnormalities	118 (11.9)
Reduced Ejection Fraction (either <45% or qualitative "severe LV dysfunction")	71 (7.1)
Right ventricular dysfunction/strain	23 (2.3)
Severe aortic stenosis (<1cm^2)	20 (2.0)
Severe pulmonary hypertension (eg, severely elevated PA systolic pressure)	15 (1.5)
Severe aortic regurgitation or severe mitral stenosis/regurgitation (qualitative)	14 (1.4)
Hypertrophic cardiomyopathy with outflow tract obstruction	4 (0.4)
Obstructive physiology (large pericardial effusion, atrial myxoma)	1 (0.1)

Abbreviations: cm, centimeter; LV, left ventricular; PA, pulmonary artery.
(Sum of individual findings greater than 215 due to some subjects having more than one finding.)

TABLE 3. **Clinical Variables associated with Major Findings on Echocardiography using Multivariate LASSO regression**

Clinical Variable	Odds Ratio	95% CI
History of CHF	1.60	(1.02, 2.57)
Abnormal ECG	1.53	(1.18, 2.48)
NT-proBNP>125 pg/ml	1.34	(1.00, 2.61)
HS-TnT>14 pg/ml	1.29	(1.00, 2.03)
History of CAD	1.24	(1.00, 1.96)
Age	1.00	(1.00, 1.00)
Male gender	1.00	(1.00, 1.43)
Abnormal heart sounds	1.00	(1.00, 1.55)
Exertional syncope	1.00	(1.00, 1.26)
Shortness of breath	1.00	(1.00, 1.67)
Chest pain	1.00	(1.00, 1.18)
Near syncope	1.00	(1.00, 1.43)
Family history of SCD	1.00	(1.00, 2.06)
SBP > 180 mm Hg	1.00	(0.82, 1.00)
SBP < 90 mm Hg	1.00	(1.00, 1.55)
History of hypertension	1.00	(1.00, 1.00)
History of dysrhythmia	1.00	(1.00, 1.20)
History of renal failure	1.00	(1.00, 1.04)
History of diabetes	1.00	(1.00, 1.12)

Abbreviations: CAD, Coronary Artery Disease; CHF, Congestive Heart Failure; CI, Confidence Interval; ECG, Electrocardiogram; Hs-TnT, high-sensitivity cardiac troponin T; mm Hg, millimeters of mercury; NT-proBNP, N-terminal pro B-type natriuretic peptide; SBP, Systolic Blood Pressure; SCD, Sudden Cardiac Death.

score) to determine which older adults with syncope are at very low risk for major, clinically significant findings on TTE.

Our results add to the recent American College of Cardiology/American Heart Association/Heart Rhythm Society guidelines on the management of syncope which recommend TTE in "selected patients presenting with syncope if structural heart disease is suspected."[18] Our risk-stratification tool offers a simple, standardized approach to determine specifically when to defer TTE testing.

Our findings can guide clinicians in deciding when to obtain TTE for ED syncope patients in the following way: Older adults presenting with syncope or near-syncope to the ED who have none of the ROMEO criteria are at extremely low risk for clinically significant findings on TTE and thus need not undergo such testing solely because of the syncopal event. Patients who have only one or more high-risk clinical variables are at higher risk (7.3%-56%) of significant TTE findings. In this subset, other factors, (eg, physician gestalt, recent previous echocardiography, patient preference, availability of echocardiography) can help guide TTE ordering. Patients with a greater number of high-risk variables may benefit from a more urgent echocardiographic evaluation.

Although on average, patients undergoing TTE had a longer length of stay than those that did not, this finding does not necessarily imply that ordering a TTE was the cause of the increased length of stay. It is possible that this positive association was due to greater underlying medical complexity or acuity of illness that resulted in a greater likelihood of admission/observation, and in turn, a greater length of stay.

Prior to implementation, our results should be externally validated in other clinical settings. In the interim, this risk-stratification tool may be used by clinicians, in conjunction with clinical judgement, to help guide the appropriate use of TTE in older adults presenting with syncope.

Our study has certain limitations. As we only enrolled patients 60 years and older, our findings may not necessarily be valid in younger populations of syncope patients. However, structural heart disease is less common in younger patients and is generally more of a concern for clinicians when evaluating syncope patients in the older age range.[29] In our study, 47% of eligible patients declined to participate and thus sampling bias may have occurred. TTEs were ordered at the discretion of treating providers, which was likely subject to physician, institutional, and regional variation; the prevalence of major TTE findings may be lower in the overall cohort than in patients who received TTE. Prior TTE reports were not available; therefore, we were not able to determine if these major findings were previously known. Importantly, we did not perform an internal or external validation of the ROMEO score due to time and resource constraints. Thus, this study represents a derivation of the score solely and would require external validation prior to clinical implementation. Also, to calculate the ROMEO score, both an hs-TnT and NT-proBNP level must be obtained. Thus, the cost savings of any potential

reduction in TTE ordering may be partially offset by the costs of increased laboratory testing. Lastly, hs-TnT assays are not currently widely available in hospitals in the United States; earlier generation cardiac troponin assays may not be a perfect substitute for hs-TnT assays. Our sensitivity analysis using an elevated threshold for hs-TnT attempted to mitigate this limitation and resulted in similar findings.

In summary, this risk-stratification tool, using five simple criteria, could help clinicians determine which older adult syncope patients can safely forgo TTE. If validated, this tool could help optimize resource utilization, and increase the value of healthcare for patients presenting with syncope.

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Electronic Order Volume as a Meaningful Component in Estimating Patient Complexity and Resident Physician Workload

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BACKGROUND: Though patient census has been used to describe resident physician workload, this fails to account for variations in patient complexity. Changes in clinical orders captured through electronic health records may provide a complementary window into workload. We aimed to determine whether electronic order volume correlated with measures of patient complexity and whether higher order volume was associated with quality metrics.

METHODS: In this retrospective study of admissions to the internal medicine teaching service of an academic medical center in a 13-month period, we tested the relationship between electronic order volume and patient level of care and severity of illness category. We used multivariable logistic regression to examine the association between daily team orders and two discharge-related quality metrics (receipt of a high-quality patient after-visit summary (AVS) and timely discharge summary), adjusted for team census, patient severity of illness, and patient demographics.

RESULTS: Our study included 5,032 inpatient admissions for whom 929,153 orders were entered. Mean daily order volume was significantly higher for patients in the intensive care unit than in step-down units and general medical wards (40 vs. 24 vs. 19, $P < .001$). Order volume was also significantly correlated with severity of illness ($P < .001$). Patients were 12% less likely to receive a timely discharge summary for every 100 additional team orders placed on the day prior to discharge (OR 0.88; 95% CI 0.82-0.95).

CONCLUSIONS: Electronic order volume is significantly associated with patient complexity and may provide valuable additional information in measuring resident physician workload. *Journal of Hospital Medicine* 2018;13:829-835. Published online first August 29, 2018. © 2018 Society of Hospital Medicine

Resident physician workload has traditionally been measured by patient census.[1,2] However, census and other volume-based metrics such as daily admissions may not accurately reflect workload due to variation in patient complexity. Relative value units (RVUs) are another commonly used marker of workload, but the validity of this metric relies on accurate coding, usually done by the attending physician, and is less directly related to resident physician workload. Because much of hospital-based medicine is mediated through the electronic health record (EHR), which can capture differences in patient complexity,[3] electronic records could be harnessed to more comprehensively describe residents' work. Current government estimates indicate that several hundred companies offer certified EHRs, thanks in large part to the Health Information Technology for Economic and Clinical Health (HITECH) Act of 2009, which aimed to promote adoption and meaningful use of health information technology.[4,5] These systems can collect important data about the usage and operating patterns of physicians, which may provide an insight into workload.[6-8]

Accurately measuring workload is important because of the direct link that has been drawn between physician workload and quality metrics. In a study of attending hospitalists, higher workload, as measured by patient census and RVUs, was associated with longer lengths of stay and higher costs of hospitalization.[9] Another study among medical residents found that as daily admissions increased, length of stay, cost, and inpatient mortality appeared to rise.[10] Although these studies used only volume-based workload metrics, the implication that high workload may negatively impact patient care hints at a possible trade-off between the two that should inform discussions of physician productivity.

In the current study, we examine whether data obtained from the EHR, particularly electronic order volume, could provide valuable information, in addition to patient volume, about resident physician workload. We first tested the feasibility and validity of using electronic order volume as an important component of clinical workload by examining the relationship between electronic order volume and well-established factors that are likely to increase the workload of residents, including patient level of care and severity of illness. Then, using or-

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der volume as a marker for workload, we sought to describe whether higher order volumes were associated with two discharge-related quality metrics, completion of a high-quality after-visit summary and timely discharge summary, postulating that quality metrics may suffer when residents are busier.

METHODS

Study Design and Setting

We performed a single-center retrospective cohort study of patients admitted to the internal medicine service at the University of California, San Francisco (UCSF) Medical Center between May 1, 2015 and July 31, 2016. UCSF is a 600-bed academic medical center, and the inpatient internal medicine teaching service manages an average daily census of 80-90 patients. Medicine teams care for patients on the general acute-care wards, the step-down units (for patients with higher acuity of care), and also patients in the intensive care unit (ICU). ICU patients are comanaged by general medicine teams and intensive care teams; internal medicine teams enter all electronic orders for ICU patients, except for orders for respiratory care or sedating medications. The inpatient internal medicine teaching service comprises eight teams each supervised by an attending physician, a senior resident (in the second or third year of residency training), two interns, and a third- and/or fourth-year medical student. Residents place all clinical orders and complete all clinical documentation through the EHR (Epic Systems, Verona, Wisconsin).[11] Typically, the bulk of the orders and documentation, including discharge documentation, is performed by interns; however, the degree of senior resident involvement in these tasks is variable and team-dependent. In addition to the eight resident teams, there are also four attending hospitalist-only internal medicine teams, who manage a service of ~30-40 patients.

Study Population

Our study population comprised all hospitalized adults admitted to the eight resident-run teams on the internal medicine teaching service. Patients cared for by hospitalist-only teams were not included in this analysis. Because the focus of our study was on hospitalizations, individual patients may have been included multiple times over the course of the study. Hospitalizations were excluded if they did not have complete Medicare Severity-Diagnosis Related Group (MS-DRG) data,[12] since this was used as our severity of illness marker. This occurred either because patients were not discharged by the end of the study period or because they had a length of stay of less than one day, because this metric was not assigned to these short-stay (observation) patients.

Data Collection

All electronic orders placed during the study period were obtained by extracting data from Epic's Clarity database. Our EHR allows for the use of order sets; each order in these sets was counted individually, so that an order set with several orders would not be identified as one order. We identified the time and date that the order was placed, the ordering physician, the identity of the patient for which the order was placed, and the location of the patient when the order was placed, to determine the level of care (ICU, step-down, or general medicine unit). To track the composite volume of orders placed by resident teams, we matched each ordering physician to his or her corresponding resident team using our physician scheduling database, Amion (Spiral Software). We obtained team census by tabulating the total number of patients that a single resident team placed orders on over the course of a given calendar day. From billing data, we identified the MS-DRG weight that was assigned at the end of each hospitalization. Finally, we collected data on adherence to two discharge-related quality metrics to determine whether increased order volume was associated with decreased rates of adherence to these metrics. Using departmental patient-level quality improvement data, we determined whether each metric was met on discharge at the patient level. We also extracted patient-level demographic data, including age, sex, and insurance status, from this departmental quality improvement database.

Discharge Quality Outcome Metrics

We hypothesized that as the total daily electronic orders of a resident team increased, the rate of completion of two discharge-related quality metrics would decline due to the greater time constraints placed on the teams. The first metric we used was the completion of a high-quality after-visit summary (AVS), which has been described by the Centers for Medicare and Medicaid Services as part of its Meaningful Use Initiative.[13] It was selected by the residents in our program as a particularly high-priority quality metric. Our institution specifically defines a "high-quality" AVS as including the following three components: a principal hospital problem, patient instructions, and follow-up information. The second discharge-related quality metric was the completion of a timely discharge summary, another measure recognized as a critical component in high-quality care.[14] To be considered timely, the discharge summary had to be filed no later than 24 hours after the discharge order was entered into the EHR. This metric was more recently tracked by the internal medicine department and was not selected by the residents as a high-priority metric.

Statistical Analysis

To examine how the order volume per day changed throughout each sequential day of hospital admission, mean orders per hospital day with 95% CIs were plotted. We performed an aggregate analysis of all orders placed for each patient per day across three different levels of care (ICU, step-down, and general medicine). For each day of the study period, we summed all orders for all patients according to their location and divided by the number of total patients in each location to identify the average number of orders written for an ICU, step-down, and general medicine patient that day. We then calculated the mean daily orders for an ICU, step-down, and general medicine patient over the entire study period. We used ANOVA to test for statistically significant differences between the mean daily orders between these locations.

To examine the relationship between severity of illness and order volume, we performed an unadjusted patient-level analysis of orders per patient in the first three days of each hospitalization and stratified the data by the MS-DRG payment weight, which we divided into four quartiles. For each quartile, we calculated the mean number of orders placed in the first three days of admission and used ANOVA to test for statistically significant differences. We restricted the orders to the first three days of hospitalization instead of calculating mean orders per day of hospitalization because we postulated that the majority of orders were entered in these first few days and that with increasing length of stay (which we expected to occur with higher MS-DRG weight), the order volume becomes highly variable, which would tend to skew the mean orders per day.

We used multivariable logistic regression to determine whether the volume of electronic orders on the day of a given patient's discharge, and also on the day before a given patient's discharge, was a significant predictor of receiving a high-quality AVS. We adjusted for team census on the day of discharge, MS-DRG weight, age, sex, and insurance status. We then conducted a separate analysis of the association between electronic order volume and likelihood of completing a timely discharge summary among patients where discharge summary data were available. Logistic regression for each case was performed independently, so that team orders on the day prior to a patient's discharge were not included in the model for the relationship between team orders on the day of a patient's discharge and the discharge-related quality metric of interest, and vice versa, since including both in the model would be potentially disruptive given that orders on the day before and day of a patient's discharge are likely correlated.

We also performed a subanalysis in which we restricted orders to only those placed during the daytime hours (7 AM-7 PM), since these reflect the work performed by the primary team, and excluded those placed by covering night-shift residents.

IRB Approval

The study was approved by the UCSF Institutional Review Board and was granted a waiver of informed consent.

RESULTS

Population

We identified 7,296 eligible hospitalizations during the study period. After removing hospitalizations according to our exclusion criteria (Figure 1), there were 5,032 hospitalizations that were used in the analysis for which a total of 929,153 orders were written. The vast majority of patients received at least one order per day; fewer than 1% of encounter-days had zero associated orders. The top 10 discharge diagnoses identified in the cohort are listed in Appendix Table 1. A breakdown of orders by order type, across the entire cohort, is displayed in Appendix Table 2. The mean number of orders per patient per day of hospitalization is plotted in the Appendix Figure, which indicates that the number of orders is highest on the day of admission, decreases significantly after the first few days, and becomes increasingly variable with longer lengths of stay.

Patient Level of Care and Severity of Illness Metrics

Patients at a higher level of care had, on average, more orders entered per day. The mean order frequency was 40 orders per day for an ICU patient (standard deviation [SD] 13, range 13-134), 24 for a step-down patient (SD 6, range 11-48), and 19 for a general medicine unit patient (SD 3, range 10-31). The difference in mean daily orders was statistically significant ($P < .001$, Figure 2a).

Orders also correlated with increasing severity of illness. Patients in the lowest quartile of MS-DRG weight received, on average, 98 orders in the first three days of hospitalization (SD 35, range 2-349), those in the second quartile received 105 orders (SD 38, range 10-380), those in the third quartile received 132 orders (SD 51, range 17-436), and those in the fourth and highest quartile received 149 orders (SD 59, range 32-482). Comparisons between each of these severity of illness categories were significant ($P < .001$, Figure 2b).

Discharge-Related Quality Metrics

The median number of orders per internal medicine team per day was 343 (IQR 261- 446). Of the 5,032 total discharged patients, 3,657 (73%) received a high-quality AVS on discharge. After controlling for team census, severity of illness, and demographic factors, there was no statistically significant association between total orders on the day of discharge and odds of receiving a high-quality AVS (OR 1.01; 95% CI 0.96-1.06), or between team orders placed the day prior to discharge and odds of receiving a high-quality AVS (OR 0.99; 95% CI 0.95-1.04; Table 1). When we restricted our analysis to orders placed during daytime hours (7 AM-7 PM), these findings were largely unchanged (OR 1.05; 95% CI 0.97-1.14 for orders on the day of discharge; OR 1.02; 95% CI 0.95-1.10 for orders on the day before discharge).

There were 3,835 patients for whom data on timing of discharge summary were available. Of these, 3,455 (91.2%) had a discharge summary completed within 24 hours. After controlling for team census, severity of illness, and demographic factors, there was no statistically significant association between total orders placed by the team on a patient's day of discharge and odds of receiving a timely discharge summary (OR 0.96; 95% CI 0.88-1.05). However, patients were 12% less likely to receive a timely discharge summary for every 100 extra orders the team placed on the day prior to discharge (OR 0.88, 95% CI 0.82-0.95). Patients who received a timely discharge summary were cared for by teams who placed a median of 345 orders the day prior to their discharge, whereas those that did not receive a timely discharge summary were cared for by teams who placed a significantly higher number of orders (375) on the day prior to discharge (Table 2). When we restricted our analysis to only daytime orders, there were no significant changes in the findings (OR 1.00; 95% CI 0.88-1.14 for orders on the day of discharge; OR 0.84; 95% CI 0.75-0.95 for orders on the day prior to discharge).

DISCUSSION

We found that electronic order volume may be a marker for patient complexity, which encompasses both level of care and

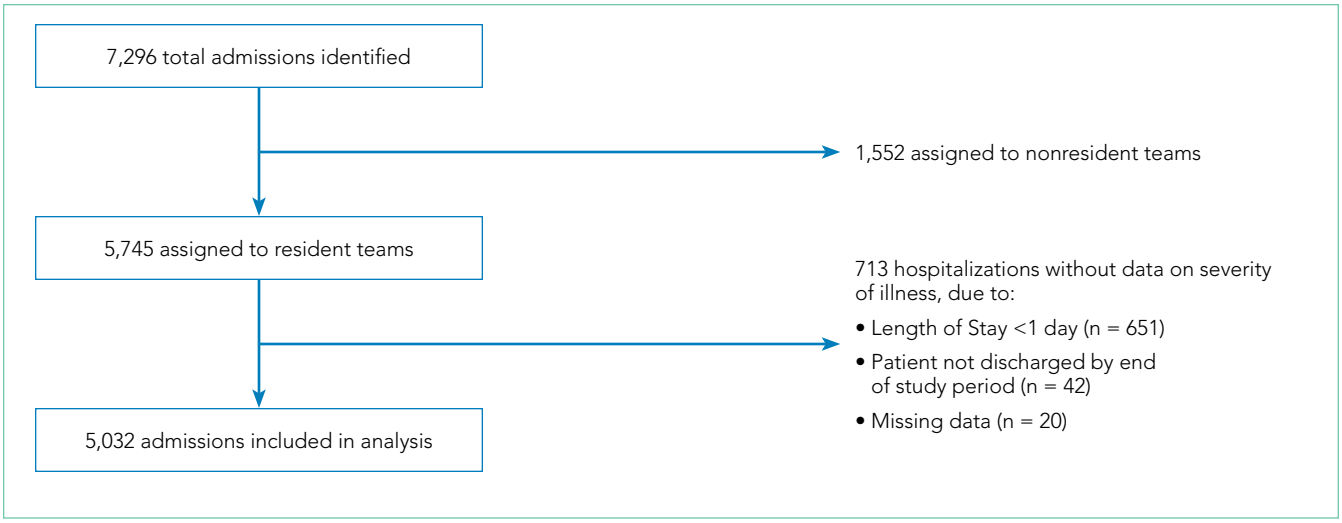

FIG 1. Study Population

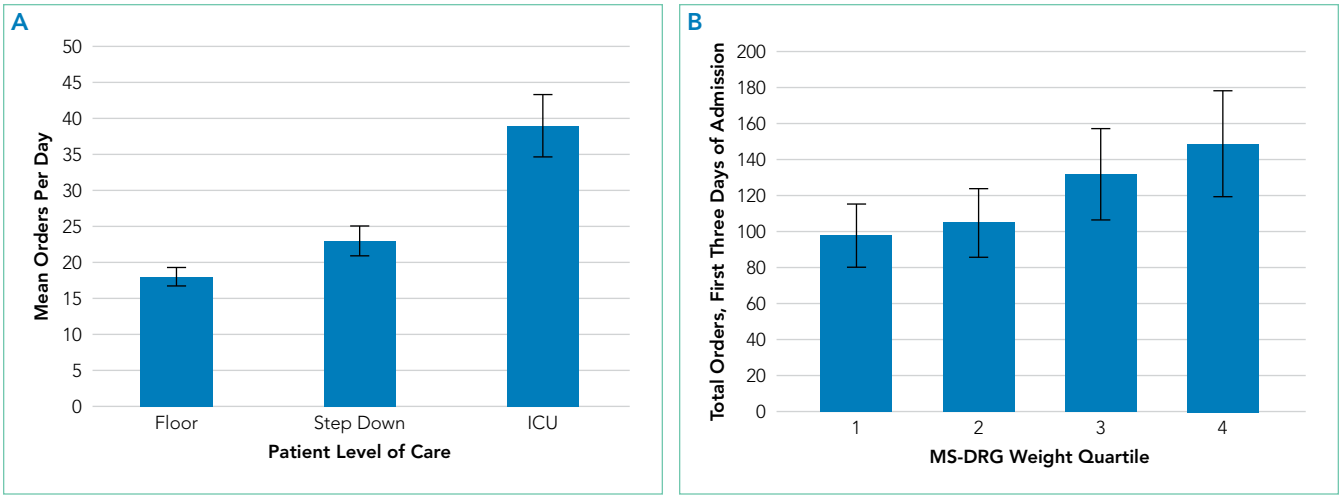

FIG 2. (A) Mean Orders per Day by Patient Level of Care; (B) Mean Total Orders during the First Three Days of Hospitalization, by Quartile of MS-DRG Severity. Abbreviation: MS-DRG, Medicare Severity-Diagnosis Related Group

severity of illness, and could be a marker of resident physician workload that harnesses readily available data from an EHR. Recent time-motion studies of internal medicine residents indicate that the majority of trainees' time is spent on computers, engaged in indirect patient care activities such as reading electronic charts, entering electronic orders, and writing computerized notes.[15-18] Capturing these tasks through metrics such as electronic order volume, as we did in this study, can provide valuable insights into resident physician workflow.

We found that ICU patients received more than twice as many orders per day than did general acute care-level patients. Furthermore, we found that patients whose hospitalizations fell into the highest MS-DRG weight quartile received approximately 50% more orders during the first three days of admission compared to that of patients whose hospitalizations fell into the lowest quartile. This strong association indicates that electronic order volume could provide meaningful additional information, in concert with other factors such as census, to describe resident physician workload.

We did not find that our workload measure was significantly associated with high-quality AVS completion. There are several possible explanations for this finding. First, adherence to this quality metric may be independent of workload, possibly because it is highly prioritized by residents at our institution. Second, adherence may only be impacted at levels of workload greater than what was experienced by the residents in our study. Finally, electronic order volume may not encompass enough of total workload to be reliably representative of resident work. However, the tight correlation between electronic order volume with severity of illness and level of care, in conjunction with the finding that patients were less likely to receive a timely discharge summary when workload was high on the day prior to a patient's discharge, suggests that electronic order volume does indeed encompass a meaningful component of workload, and that with higher workload, adherence to some quality metrics may decline. We found that patients

TABLE 1. **Treatment Team and Patient Factors and Association with High-Quality After-Visit Summary Completion**[a]

High-Quality After-Visit Summary Completed?	No (n = 1,357)	Yes (n = 3,657)	Adjusted OR	Adjusted *P* Value
Team Factors				
Team orders on day of discharge, median (IQR)	345 (265-446)	341 (261-444)	1.01 (0.96, 1.06)[b]	.784
Team orders on day prior to discharge, median (IQR)	352 (268-448)	344 (261-449)	0.99 (0.95, 1.04)[b]	.733
Daily team census, median (IQR)	14.5 (12-15)	14 (12-15)	0.95 (0.93, 0.99)	.001
Patient Factors				
Female sex, n (%)	667 (48.5%)	1,820 (49.8%)	1.04 (0.92, 1.19)	.492
Age in years, mean (SD)	60.4 (20.4)	59.5 (19.0)	0.99 (0.98, 0.99)	.001
Race, n (%)				
White or Caucasian	644 (46.8%)	1,694 (46.3%)	Ref	Ref
Asian	257 (18.7%)	725 (19.8%)	1.02 (0.83, 1.26)	.867
Black or African American	224 (16.3%)	533 (14.6%)	0.85 (0.69, 1.06)	.147
Other/Unknown	250 (18.2%)	705 (19.3%)	0.92 (0.78, 1.10)	.362
Quartile of MS-DRG payment weight, n (%)				
Quartile 1 (0.51-0.94)	368 (26.8%)	903 (24.7%)	Ref	Ref
Quartile 2 (0.95-1.28)	322 (23.5%)	923 (25.3%)	1.15 (0.96, 1.38)	.121
Quartile 3 (1.29-1.79)	414 (30.2%)	994 (27.2%)	0.98 (0.82, 1.16)	.807
Quartile 4 (1.80-17.66)	269 (19.6%)	833 (22.8%)	1.26 (1.04, 1.52)	.017
Primary Payor, n (%)				
Commercial	284 (20.7%)	857 (23.4%)	Ref	Ref
Medicare	638 (46.4%)	1,780 (48.7%)	1.09 (0.90, 1.32)	.370
Medicaid	433 (31.5%)	992 (27.1%)	0.77 (0.65, 0.93)	.005
Other/Unknown	20 (1.5%)	28 (0.8%)	0.47 (0.26, 0.85)	.013

[a]A high-quality after-visit summary must include three components: a principal hospital problem, patient instructions, and follow-up information.

[b]Orders have been scaled by 100 in unadjusted logistic regression for ease of OR interpretation.

Abbreviations: IQR, interquartile range; MS-DRG, Medicare Severity-Diagnosis Related Group

who received a timely discharge summary were discharged by teams who entered 30 fewer orders on the day before discharge compared with patients who did not receive a timely discharge summary. In addition to being statistically significant, it is also likely that this difference is clinically significant, although a determination of clinical significance is outside the scope of this study. Further exploration into the relationship between order volume and other quality metrics that are perhaps more sensitive to workload would be interesting.

The primary strength of our study is in how it demonstrates that EHRs can be harnessed to provide additional insights into clinical workload in a quantifiable and automated manner. Although there are a wide range of EHRs currently in use across the country, the capability to track electronic orders is common and could therefore be used broadly across institutions, with tailoring and standardization specific to each site. This technique is similar to that used by prior investigators who characterized the workload of pediatric residents by orders entered and notes written in the electronic medical record.[19] However, our study is unique, in that we explored the relationship between electronic order volume and patient-level severity metrics as well as discharge-related quality metrics.

Our study is limited by several factors. When conceptualizing resident workload, several other elements that contribute to a sense of "busyness" may be independent of electronic orders and were not measured in our study.[20] These include communication factors (such as language discordance, discussion with consulting services, and difficult end-of-life discussions), environmental factors (such as geographic localization), resident physician team factors (such as competing clinical or educational responsibilities), timing (in terms of day of week as well as time of year, since residents in July likely feel "busier" than residents in May), and ultimate discharge destination for patients (those going to a skilled nursing facility may require discharge documentation more urgently). Additionally, we chose to focus on the workload of resident teams, as represented by team orders, as opposed to individual work, which may be more directly correlated to our outcomes of interest, completion of a high-quality AVS, and timely discharge summary, which are usually performed by individuals.

Furthermore, we did not measure the relationship between our objective measure of workload and clinical endpoints. Instead, we chose to focus on process measures because they are less likely to be confounded by clinical factors independent

TABLE 2. **Treatment Team and Patient Factors and Association with Timely Discharge Summary Completion**[a]

Timely Discharge Summary Completed?	No (n = 380)	Yes (n = 3,455)	Adjusted OR	Adjusted *P* Value
Team Factors				
Team orders on day of discharge, median (IQR)	354 (271-452)	340 (260-444)	0.96 (0.88, 1.05)[b]	.379
Team orders on day prior to discharge, median (IQR)	375 (281-590)	345 (251-451)	0.88 (0.82, 0.95)[b]	.002
Daily team census, median (IQR)	13.5 (12-15)	13 (12-15)	0.98 (0.94, 1.03)	.457
Patient Factors				
Female sex, n (%)	208 (54.7%)	1,683 (48.7%)	0.79 (0.63, 0.98)	.030
Age in years, mean (SD)	56 (19.5)	60 (19.4)	1.01 (1.00, 1.02)	.002
Race, n (%)				
White or Caucasian	179 (47.1%)	1,577 (45.6%)	Ref	Ref
Asian	70 (18.4%)	711 (20.6%)	0.87 (0.61, 1.26)	.465
Black or African American	65 (17.1%)	501 (14.5%)	0.78 (0.54, 1.12)	.183
Other/Unknown	66 (17.4%)	666 (19.3%)	0.83 (0.61, 1.13)	.238
Quartile of MS-DRG payment weight, n (%)				
Quartile 1 (0.51-0.94)	106 (27.9%)	852 (7.1%)	Ref	Ref
Quartile 2 (0.95-1.28)	88 (22.6%)	849 (26.7%)	1.10 (0.82, 1.49)	.525
Quartile 3 (1.29-1.79)	92 (23.6%)	989 (47.0%)	1.19 (0.88, 1.61)	.261
Quartile 4 (1.80-17.66)	94 (24.1%)	760 (19.2%)	0.90 (0.67, 1.22)	.506
Primary Payor, n (%)				
Commercial	92 (24.2%)	771 (22.3%)	Ref	Ref
Medicare	164 (43.2%)	1,677 (48.5%)	0.92 (0.66, 1.27)	.594
Medicaid	120 (31.6%)	973 (28.2%)	0.95 (0.71, 1.29)	.751
Other/Unknown	4 (1.1%)	34 (1.0%)	0.91 (0.31, 2.65)	.867

[a]A timely discharge summary must be filed within 24 hours of the time of discharge.
[b]Orders have been scaled by 100 in unadjusted logistic regression for ease of OR interpretation
Abbreviations: IQR, interquartile range; MS-DRG, Medicare Severity-Diagnosis Related Group; SD, standard deviation..

of physician workload.[21] Future studies should also consider obtaining direct resident-level measures of "busyness" or burnout, or other resident-centered endpoints, such as whether residents left the hospital at times consistent with duty hour regulations or whether they were able to attend educational conferences.

These limitations pose opportunities for further efforts to more comprehensively characterize clinical workload. Additional research is needed to understand and quantify the impact of patient, physician, and environmental factors that are not reflected by electronic order volume. Furthermore, an exploration of other electronic surrogates for clinical workload, such as paging volume and other EHR-derived data points, could also prove valuable in further describing the clinical workload. Future studies should also examine whether there is a relationship between these novel markers of workload and further outcomes, including both process measures and clinical endpoints.

CONCLUSIONS

Electronic order volume may provide valuable additional information for estimating the workload of resident physicians caring for hospitalized patients. Further investigation to determine whether the statistically significant differences identified in this study are clinically significant, how the technique used in this work may be applied to different EHRs, an examination of other EHR-derived metrics that may represent workload, and an exploration of additional patient-centered outcomes may be warranted.

Disclosures: Rajkomar reports personal fees from Google LLC, outside the submitted work. Dr. Khanna reports that during the conduct of the study, his salary, and the development of CareWeb (a communication platform that includes a smartphone-based paging application in use in several inpatient clinical units at University of California, San Francisco [UCSF] Medical Center) were supported by funding from the Center for Digital Health Innovation at UCSF. The CareWeb software has been licensed by Voalte.

Disclaimer: The views expressed in the submitted article are of the authors and not an official position of the institution.

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You Can't Have It All: The Experience of Academic Hospitalists During Pregnancy, Parental Leave, and Return to Work

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BACKGROUND: The United States lags behind most other countries regarding the support for working mothers and parental leave. Data are limited to describe the experience of female hospital medicine physicians during pregnancy, parental leave, and their return to work in academic hospital medicine.

METHODS: We conducted a qualitative descriptive study including interviews with 10 female academic hospitalists chosen from institutions across the country that are represented in Society of Hospital Medicine (SHM) Committees. Interview guides were based on the following domains: experience in pregnancy, parental leave, and return to work. Interviews were recorded, transcribed verbatim, and analyzed using a general inductive approach to theme analysis using the ATLAS.ti software (Scientific Software Development GmbH, Berlin, Germany).

PRIMARY OUTCOME: Women in hospital medicine experience the following six common challenges in their experience as new parents, each of which has the potential to impact their career trajectory, wellness, and are associated with areas for institutional improvement: (1) access to paid parental leave, (2) physical challenges, (3) breastfeeding, (4) career opportunities, (5) colleague responses, and (6) empathy in patient care. *Journal of Hospital Medicine* 2018;13:836-839. © 2018 Society of Hospital Medicine

Despite recent advances made in medicine, gender-based disparities persist.[1-3] In particular, women with children have barriers to career advancement and show evidence of slower career advancement.[1,2] Multiple challenges for working women experiencing motherhood have been described. In academic medicine in the United States, women have limited access to paid parental leave.[4-6] For women who choose to breastfeed, there is limited time, space, and support available for breastfeeding.[7] Furthermore, sleep deprivation in the postpartum period significantly impacts the ability to function at work.[8]

Hospital medicine is a unique specialty as it comprises 47% women, 80% of whom are aged less than 40 years, suggesting that a large portion are women of childbearing age.[9] The field poses known challenges to this population, including shift work, atypical schedules, and unpredictable hours. We conducted a descriptive qualitative study to improve our understanding of the experience of female academic hospitalists who have experienced pregnancy, parental leave, and the return to work as faculty. Our goal was to both explore the challenges to undergoing this experience and discover solutions to support female academic hospitalists.

METHODS

Study Design

We conducted a qualitative descriptive study of female hospitalists recruited from academic institutions represented in Society of Hospital Medicine (SHM) committees. Interviews were conducted between November 2017 and February 2018. Participants completed an informed consent and a demographic survey prior to the interview. Each interview lasted approximately 30 minutes; discussions were recorded on digital records and transcribed verbatim. This protocol was reviewed and granted exemption by the Institutional Review Board at the University of Colorado.

Population

We recruited participants from a selection of hospital medicine groups nationally, chosen from SHM committee representation. A purposeful snowball approach was used to identify hospitalists from representative programs and seek their recommendation for hospitalists from other targeted programs. Ten hospitalists were approached by e-mail to determine their interest in participation, and all of them agreed to participate. Each participant experienced new parenthood within the last seven years.

Framework

We constructed our interview to represent the following timeline associated with having children as it pertains to a hospi-

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talist position: pregnancy, parental leave, and the return to work. The interview guide was structured to invoke the positive aspects, challenges, and solutions within each domain (Appendix 1).

Analysis

Codes were inductively developed from the interview data by a team of three board-certified internal medicine physicians (E.G., A.M., and C.J.), one of whom had prior training and experience with qualitative interviews and analysis (C.J.). Among the coders, two (E.G. and A.M.) conducted the semistructured interviews. Code disparities were reconciled by team consensus, where the primary coder facilitated the discussions. Themes were developed inductively from the codes, and the analysis was completed using a team-based iterative approach that was facilitated using ATLAS.ti.[10] Thematic saturation was achieved. This study was approved by the Colorado Multiple Institutional Review Board.

RESULTS

The demographics and the characteristics of the hospital medicine group are shown in Table 1. Although we asked questions about both the positive and challenging aspects of the experience of parenthood, the interviews tended to focus more on the challenges faced and on areas for optimization.

TABLE 1. **Characteristics of Participating Physicians, Female Academic Hospitalists**

		N (%)
Clinical FTE	0.7-1.0	6 (60)
	0.4-0.7	2 (20)
	<0.4	2 (20)
Years in Practice	>7	3 (30)
	5-7	3 (30)
	<5	4 (40)
Academic Title	Instructor	
	Assistant Professor	10 (100)
	Associate Professor	
Group Characteristics		
Members	>50	7 (70)
	30-50	1 (10)
	<30	2 (20)
Region	Northeast	1 (10)
	Southeast	2 (20)
	Midwest	2 (20)
	Mountain West	2 (20)
	Pacific Northwest	3 (30)

Paid Parental leave

Most of the participants described inadequate paid parental leave, with minimal transparency in the processes for ensuring time off following the birth of their child, resulting in "haggling" with bosses, human resources, and the administrative staff. Rarely was a formal parental leave policy in place. Once a parental leave plan was established, several women reported the financial burden associated with a leave that was partially, or fully, unpaid.

> *"All of my leave was unpaid. .. managed to finagle short-term disability into paying for it… the system was otherwise set up to screw me financially."*

For the three women who did experience sufficient paid parental leave, they recognized the financial and emotional benefit and suggested that further optimization would include a prebirth schedule to account for the physical challenges and potential complications.

Physical Challenges

All of the women described significant physical challenges when working during pregnancy, resulting in limited bandwidth for additional academic activities outside of direct clinical care responsibilities.

> *"Exhaustion that hits you in your pregnancy and then you have to round. I used to lie on the floor of my office, take a little nap, wake up, write some notes, go home, take another nap, wake up, write some more notes."*

Upon return to work, women reported additional physical challenges related to sleep deprivation, impacting their productivity with academic work and emotional well-being.

> *"I came back from maternity leave and I was sleep-deprived and exhausted, I didn't have the energy. All of these great projects that I had started or dreamed of … dwindled and died on the vine."*

Solutions suggested by the participants included creation of a flexible schedule with a ramp-up and ramp-down period around the birth.

Breastfeeding

The majority of participants in this study encountered several challenges associated with a shared goal of breastfeeding according to evidence-based guidelines.[11] Designated pumping areas were often inconveniently located and not conducive to multitasking.

> *"It's two chairs that are behind a curtain in a women's locker room in the basement of the hospital, that are tiny and gross. No computers, so I felt like I was wasting time."*

One hospitalist described carving out time for pumping in her office while multitasking with clinical work.

> *"I would get to work, set up, and pump while chart reviewing. Then I would go and see people… and come back to my office and pump and write a few notes. And go out and see more patients, and then pump and write a few more notes. And then pump, and then go home. I was like a cow."*

Women highlighted the barriers that could be optimized such as creating time in the clinical schedule for pumping, a physical space to breastfeed or pump, and accessible milk storage facilities.

TABLE 2. **Solutions for the Challenges Reported Related to Pregnancy, Parental Leave, and Return to Work, with Representative Quotes**

Theme	Solution
Lack of Paid Parental Leave	"Two separate leaves: one for pregnancy complications, which you can invoke if you have a complication, and one for post-baby arrival, so you are not trying to conserve post-baby time by working with complications."
Physical Challenges	"Planning the schedule so that when someone comes back they can have either a ramp-up with reduced complement of shifts, or structure shifts so that you're not working a long block in a row."
Breastfeeding Barriers	Addressing access to space, time, and milk storage to alleviate the challenges noted in the quote: "Pumping every 3-4 hours: stopping what you're doing, finding an empty room to pump, finding a place to store your milk, then going back to work, three times per shift, for the next 9 months of your life, was hell."
Career Opportunities	"My boss... is pretty conscientious about, 'let's save that opportunity for her, when she comes back, it would be most appropriate for her.' So I don't feel like I got left over for any opportunity."
Colleague Responses	"The role-modeling and getting permission to prioritize my children. I feel like I am surrounded by a group of people that really understands the need to balance work and family and support each other." "The Physician Moms Group on Facebook, it's amazing it's now 70,000 people…But the power of that support, I wish it had started earlier."
Empathy Gain	"I'm just more sensitive to people's lives outside the hospital, so, you know, when it's difficult for a family member to get there because they have three other kids they are taking care of or, somebody that says they are leaving AMA, but it's because they have a sick kid at home. I just have a better context for that."

Career Opportunities

When asked about the impact of parental leave on career opportunities, a few of the women described a phenomenon of no longer being asked to participate or being left out of prior projects.

> *"People didn't want to offer you things or give you things because they realize you're having this transition in your life. Not out of animosity, but out of courtesy that they don't want to fill up your place even more. Her plate is full; we are not going to ask her to do anything extra."*

However, two women specifically reported a supportive environment without a loss of opportunities, often referenced as a boss who "saved" projects for their return.

Colleague Responses

One participant used the term "microaggressions," to describe passive aggressions encountered by their colleagues or leadership.

> *"(A colleague) was diagnosed with pre-eclampsia, and very urgently had to deliver and couldn't cover a week of shifts…She was asked initially to find her own coverage…Not treating (pregnancy) similar to other serious illnesses is what I would term a microaggression."*

Yet, women in our study also reported positive responses from colleagues and the importance of support networks of physician mothers (Table 2).

Empathy in Patient Care

Finally, the experience of motherhood impacted all of the women as physicians, described as increased empathy, patience, and understanding of difficult family situations.

> *"I'm just more sensitive to people's lives outside the hospital, so, you know, when it's difficult for a family member to get there because they have three other kids they are taking care of or, somebody that says they are leaving AMA, but it's because they have a sick kid at home. I just have a better context for that."*

DISCUSSION

Gender disparities persist in both internal medicine and hospital medicine.[1] Providers in this descriptive qualitative study suggested that the following factors contribute: lack of paid parental leave and the associated financial penalties, loss of career opportunities, the physical challenges associated with pregnancy, decreasing productivity, and the amount of time and effort involved in breastfeeding. However, the participants also shared valuable ideas for future solutions to relieve the challenges imposed on working physician mothers (Table 2).

Breaking the Glass Ceiling

Participants noted the importance of a paid leave policy that encompasses not only maternity leave but also a flexible scheduling period before and after the leave to account for the challenges of pregnancy and new motherhood. Paid parental leave is rare in academic settings, but studies from other industries show that when women take paid leave, they are more likely to remain in the workforce 9-12 months afterward, work more weekly hours, and feel more loyal to their organization.[12,13] In the rare instance when negotiations around leave violate local policy or the law, women should be encouraged to seek guidance from their human resources department.

Me Too: Building Solidarity

Women in our study reported the value of a supportive workplace in easing their transition into motherhood. Specifically, they noted that a supportive boss who protected their career opportunities prevented momentum loss in their career trajectory. Access to mutual supports such as the Physicians Mom Group, a well-established Facebook group comprising more

than 70,000 women, was referenced as a meaningful way to share joys and tribulations related to balancing a career as a physician and motherhood. Growth of similar support systems within institutions will further support this experience.

Time's Up: The Promotion Clock

Women in our study described a prolonged period of diminished productivity related to having children, coinciding with a set time to promotion in academics. Flexible promotion schedules may impact women's ability to successfully undergo promotion.

FUTURE DIRECTION

The aim of this study was to represent a shared set of experiences of female academic hospitalists who participated; therefore, the results may not be generalizable beyond this group. Due to the use of a purposeful snowball approach, there was a potential for selection bias. Future research may include comparing the experience of women at institutions that offer paid leave versus those that do not and the impact on retention, promotion, and well-being.

CONCLUSION

Women in hospital medicine encounter several challenges to having children, but they are also motivated to provide solutions. Efforts to improve the institutional and cultural landscape to better support women physicians with children are critical to prevent attrition of women and ensure equitable academic promotion and achievement of leadership positions.

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Who Consults Us and Why? An Evaluation of Medicine Consult/Comanagement Services at Academic Medical Centers

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Although general medicine consultation is an integral component of inpatient medical care and a requirement of internal medicine training, little is known about current consultative practice. We used a cross-sectional, prospective survey design to examine current practices at 11 academic medical centers over four two-week periods from July 2014 through July 2015. Out of 11 consult services, four had comanagement agreements with surgical services, primarily with orthopedic surgery. We collected data regarding 1,264 consultation requests. Most requests (82.2%) originated from surgical services, with most requests originating from either orthopedic surgery (44.4%) or neurosurgery (11.6%). The most common reason for consultation at sites with a consult and comanagement service was medical management/comanagement (23.3%) and at sites with a consult-only service was preoperative evaluation (16.4%). On average, consultants addressed more than two reasons per encounter. Many of these reasons were unidentified by the consulting service. Learners on these services should perform comprehensive evaluations to identify potentially unidentified issues. *Journal of Hospital Medicine* 2018;13:840-843. Published online first August 29, 2018. © 2018 Society of Hospital Medicine

The role of internists in consultation has considerably expanded over the past half century. Consulting general internists increasingly work across disciplines to coordinate complex care.[1,2] Some internists assume a "comanagement" role with surgical specialties. This role requires sharing responsibility and accountability and involvement in admission/discharge processes.[3-6] Internal medicine (IM) residents are required to serve as consultants.[7] Yet, aside from observations collected 30 to 40 years ago, limited information is available for guiding educators in developing consultative curricula.[2,8-10] We sought to assess current consultative practices across a sample of IM training programs. Specifically, we examined which services consult IM and their reasons for consultation (RFCs).

METHODS

We collected data on consultation requests at 11 United States academic medical centers (AMCs). We applied a selective sampling approach that leveraged existing relationships and interest in consultative medicine to identify institutions across a variety of geographic locations. We collected data regarding the consult service structure at each site, including data on the presence or absence of comanagement services and consult requests received.

Data Collection Tool

Investigators at the University of Texas Health San Antonio (UTHSA) drafted the data collection tool. Iterative feedback on the data collection tool was obtained from the research consortium (final tool, Supplemental Figure). Data collected included service requesting consultation, RFC, time request was made (day/night), who first saw the patient (eg, resident, attending), whether requesting and consulting providers verbally communicated, and whether patients were transferred to medicine. Respondents also estimated how often RFCs were encountered during their general medicine services.

To streamline data collection, we used click boxes and drop-down lists that included diagnoses and symptoms. The use of these predetermined RFCs was based on prior studies and discussion with the research consortium on common RFCs in clinical practice. A write-in field was also included. Respondents could select multiple RFCs in the case of multiple questions. Respondents also provided data regarding clinical issues that were incidentally identified during their initial patient assessments. Incidentally identified issues are hereafter called "additional RFCs" for differentiation from stated RFCs. Prior to data collection, the tool was piloted at UTHSA.

Data Collection, Categorization, and Analysis

Participants submitted data using Survey Monkey (Palo Alto, California). Emails with the survey link were sent daily. Specific participants for each data collection period were chosen by

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TABLE 1. **Rotation Characteristics of General Medicine Consultation Services**

School/Hospital	Required vs Elective	Rotation Length	Number of Residents	Point of Contact	Comanagement Service?
CUMC/NYP[a]	Required	4 weeks	4 (PGY 3)	Resident	No
HMS: MGH[b]	Required	2 weeks	2 (PGY 3)	Resident	No[c]
Johns Hopkins Hospital	Elective	2 weeks	n/a[d]	General medicine fellow	No
MUSC[e] Health Medical Center	Elective	4 weeks	1 (PGY 1-3)	Attending	No[c]
UC Davis[f] Medical Center	Required	2 weeks	2 (PGY 2-3)	Resident	No
UCSF: SFGH[g]	Required	2 weeks	1 (PGY 3)	Resident	Yes; with orthopedics
UC Denver: DHHA[h]	Elective	1 week	1 (PGY 2-3)	Attending	Yes; with multiple services
University of Colorado Hospital	Elective[i]	4 weeks	2 (PGY 2-3)	Resident, NP/PA fellow, or attending	Yes; with orthopedics
University of Michigan Health Center	n/a[k]	2 weeks	n/a[j]	Attending	Yes; with orthopedics
UTHSA: University Hospital[l]	Required	4 weeks	2-3 (PGY 3)	Resident	No
UTHSA: Audie L. Murphy VA Hospital	Required	4 weeks	2-3 (PGY 3)	Resident	No

[a]Columbia University Medical Center/New York-Presbyterian Hospital; [b]Harvard Medical School: Massachusetts General Hospital; [c]Separate comanagement service with orthopedics; these patients were not captured in our data; [d]Service staffed by general internal medicine fellows; [e]Medical University of South Carolina; [f]University of California, Davis; [g]University of California, San Francisco: San Francisco General Hospital; [h]University of Colorado Denver: Denver Health and Hospital Authority; [l]University of Texas Health San Antonio; [i]Required for PGY 2 and 3 residents in the hospitalist training program; [k]Service staffed solely by attending physicians.

each site. Days with no data entry were confirmed by the study coordinator. Each institution collected data for four two-week periods from July 2014 to July 2015 for a total of eight weeks. We did not track follow-up encounters. Repeat consultations for different reasons were considered new consults.

All survey responses and free-text RFC entries were independently reviewed and categorized by two authors (E.W. and M.S.). New categories were created if needed. If reviewers disagreed, a third reviewer (C.M.) reviewed the RFC. The research consortium reviewed the final list of categories and entries.

We calculated descriptive statistics using SAS version 9.3 (SAS Institute, Inc., Cary, North Carolina). Each analysis used complete responses for each survey component. We separately analyzed services with and without comanagement components. The study was approved by UTHSA's Institutional Review Board.

RESULTS

A total of 11 AMCs that represent nine academic affiliations participated in this study (Table 1). Of the 11 AMCs, seven were public nonprofit, three were private nonprofit, and one was a Veterans Health Administration facility. Out of the 11 AMCs, nine sites included residents on the consult service, and the rotation was required at six of the sites. Most sites with residents had a formal curriculum that ranged from curated articles to online modules. Out of the 11 services, four were consult and comanagement services. All four co-managed orthopedic patients, and one also included other patients.

Data for 1,264 patient encounters with 2,778 RFCs were collected. A total of 1,218 of the surveys (96.4%) were fully completed, and only five surveys were missing data for multiple questions. A total of seven sites adhered to the planned protocol. Among the sites, one site had one incomplete collection period, one site missed one collection period, and one site missed two collection periods.

Most consultations (87.1%) were requested during the day. Many patients (55.9%) were initially seen by residents, and 32.4% of the patients were initially seen by an attending. Respondents reported communicating verbally with the requesting team in 93.9% of instances. Among the patients, 7.8% were transferred to medicine following initial consultation. This percentage was higher (10.2%) in services without comanagement.

The average number of new consults per day per site was 2.24. The range for individual sites was 1.36-3.48. The maximum number of new consults in one day was 10. All sites had at least one day without new consults. The mean number of RFCs per encounter was 2.20 (median 2, range 1-13). In 226 of 360 encounters in which comanagement was an RFC, the respondent enumerated the other specific RFCs addressed. In these encounters, the mean number of RFCs (in addition to comanagement) was 3.02.

Most requests (82.2%) originated from surgical services. Among all surgical services, orthopedic surgery requested the highest number of consultations (67.5% for services with a comanagement component; 28.5% for services without) and 81.2% of the 360 comanagement encounters. Refer to Supplemental Table 1 for detailed information on the services that requested consultation.

The most common RFC was comanagement (13.0% across the entire study; 23.3% for services with a comanagement component; Table 2). For services without comanagement, preoperative evaluation was the most common RFC (16.4%). Other frequent RFCs across the entire study included blood pressure management (8.9%), glycemic management (7.2%), and renal failure (3.9%). Additional (unstated) RFCs were addressed in 944 patients (34.0%), and blood pressure management was the most common additional RFC.

Respondents indicated that 54.9% of RFCs were clinical topics that are "often" or "always" encountered in IM inpatient

TABLE 2. **Summary of Most Common Reasons for Consultation**[a]

Reason for Consultation (RFC)	Frequency of RFC (n, %)		
	At All Sites (n = 2,778)	At Sites with Consult Service (n = 1,476)	At Sites with Consult and Comgmt Service (n = 1,302)
Medical management / comanagement	360 (13.0)	57 (3.9)	303 (23.3)
Preoperative evaluation	299 (10.8)	242 (16.4)	57 (4.4)
Blood pressure management	249 (8.9)	127 (8.6)	122 (9.4)
Cardiovascular	234 (8.4)	131 (8.9)	103 (7.9)
Sinus tachycardia or tachycardia, NOS	60 (2.2)	38 (2.6)	22 (1.7)
Atrial fibrillation or flutter	48 (1.7)	32 (2.2)	16 (1.2)
Heart failure	33 (1.2)	21 (1.4)	12 (0.9)
Renal and metabolic	207 (7.5)	127 (8.6)	80 (6.1)
Renal failure	107 (3.9)	57 (3.9)	50 (3.8)
Hyponatremia	57 (2.1)	37 (2.5)	20 (1.5)
Hyperkalemia	15 (0.5)	12 (0.8)	3 (0.2)
Hematology	201 (7.2)	109 (7.4)	92 (7.1)
Antithrombotic management	55 (2.0)	33 (2.2)	22 (1.7)
Anemia	48 (1.7)	23 (1.6)	25 (1.9)
Venous thromboembolic disease	37 (1.3)	15 (1.0)	22 (1.7)
Glycemic management	199 (7.2)	102 (6.9)	97 (7.5)
Gastrointestinal	142 (5.1)	82 (5.6)	60 (4.6)
Gastroesophageal reflux disease	20 (0.7)	–	20 (1.5)
Abnormal liver-associated enzymes	18 (0.6)	15 (1.0)	3 (0.2)
Cirrhosis	17 (0.6)	15 (1.0)	2 (0.2)
Pulmonology and upper respiratory	127 (4.6)	50 (3.4)	77 (5.9)
Hypoxia and hypoxic respiratory failure	35 (1.3)	16 (1.1)	19 (1.5)
Obstructive sleep apnea	21 (0.8)	7 (0.5)	14 (1.1)
Chronic obstructive pulmonary disease	19 (0.7)	3 (0.2)	16 (1.2)
Infectious diseases	108 (3.9)	65 (4.4)	43 (3.3)
Urinary tract infection	21 (0.8)	13 (0.9)	8 (0.6)
Human immunodeficiency virus	11 (0.4)	3 (0.2)	8 (0.6)
Pneumonia	10 (0.4)	9 (0.6)	1 (0.0)
Transfer to medicine	76 (2.7)	68 (4.6)	8 (0.6)
Psychiatry and substance abuse	75 (2.7)	32 (2.2)	43 (3.3)
Alcohol use, misuse, and withdrawal	28 (1.0)	14 (0.9)	14 (1.1)
Depression	13 (0.5)	3 (0.2)	10 (0.8)
Endocrinology	59 (2.1)	27 (1.8)	32 (2.5)
Hypothyroidism	17 (0.6)	5 (0.3)	12 (0.9)
Osteoporosis and fragility fractures	16 (0.6)	4 (0.3)	12 (0.9)
Other	442 (15.9)	257 (17.4)	185 (14.2)
Altered mental status	50 (1.8)	41 (2.8)	9 (0.7)
Shortness of breath	49 (1.8)	37 (2.5)	12 (0.9)
Fever	38 (1.4)	27 (1.8)	11 (0.8)

[a]Includes categories of reason for consultation representing greater than 2% of total. For relevant categories, up to 3 most common reasons given as long as at least 10 consults for the reason.
Abbreviations: Comgmt, comanagement; NOS, not otherwise specified.

services. In 11.8% of encounters, the RFC was "rarely" or "never" encountered; the most common RFCs in such encounters were comanagement (53.4%), preoperative evaluation (17.4%), and transfer to medicine (5.4%).

DISCUSSION

Our study provides insights into the consultative landscape of AMCs and identified who consults IMs and their RFCs. Thus, our study has implications for resident consultative education. The consult services included in our study presented varied structures, including those that require medicine consultation as a resident rotation and those with comanagement agreements. Consistent with the results of prior studies, surgical services requested the majority of consults, with orthopedic surgery generating the highest number of requests. Consultation requests from neurosurgery were higher than previously reported.[2,8,9]

Our study reveals that comanagement and preoperative evaluation are the most common RFCs and are the least commonly encountered RFCs in IM inpatient services. The broad nature of these RFCs speaks to an increasing need for compre-

hensive consultative care. Consultants addressed a wide range of clinical issues, including rare entities that defy easy categorization (eg, Moyamoya disease). This broad landscape presents challenges in focusing curricular content areas outside of comanagement and preoperative evaluation but does provide evidence "to expect the unexpected" in IM consultation, as has been previously noted.[8]

In over a third of encounters, consultants addressed an issue that was not stated in the initial RFC. Consultants also addressed more than two RFCs per encounter. These observations suggest that medicine consult services may be essentially comanaging some patients even when a comanagement care model is not formally in place. These findings provide rationale for the continued expansion of comanagement services.[11]

Our study provides further evidence that, in modern consultative practice, "determining your customer" is more important than "determining the question."[12-14] We work in an era in which comanagement services are increasingly prevalent but are not ubiquitous and in which IM consultants routinely address multiple issues. Prior studies indicated that most surgeons do not believe that consults should be limited to specific questions and instead prefer comanagement.[13] Understanding the expectations of the requesting physician is therefore important and highlights the importance of verbal communication at the time of initial consultation. Ongoing interprofessional communication is a vital skill that residents should acquire.

Our study has several limitations. Although our sites represented a varied sample, we focused on AMCs. Therefore, our study may not reflect consultative experiences in nonacademic hospitals or sites without dedicated consult services. Trade-offs exist in our data collection approach, which provided predetermined RFCs. We selected our methodology to facilitate data entry and to aid RFC categorization. Nevertheless, it may have lessened the clinical nuance of submitted data. The provision of predetermined RFCs may have influenced issue selection by the respondents. However, in 473 encounters (37.4%), the survey respondents provided free-text entries for the stated RFC, and 944 additional RFCs were written in as responses. These results demonstrated that respondents did not limit themselves to the predetermined list. We did not perform chart reviews to validate data. Finally, our data were a cross-section of initial consultations. We lack information on subsequent diagnoses or additional clinical issues that developed later.

In conclusion, we found varied consultative experiences across AMCs. However, preoperative evaluation and perioperative comanagement – particularly of orthopedic and neurosurgical patients – were common and should be included in curricula. Faculty should recognize the unique nature of IM consultation to prepare residents. Specifically, faculty should prepare residents to expect to identify and address unstated medical issues and to provide comprehensive assessments regardless of whether the consultative structure has a comanagement component. Given the unique nature of consultative IM work and the possibility of discordant expectations between consulting and requesting physicians, perhaps the most valuable skill to impart to residents is effective and regular communication.

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Impact of Clinical Specialty on Attitudes Regarding Overuse of Inpatient Laboratory Testing

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Routine laboratory testing is common among hospitalized patients, with associated harm. Attitudes toward testing and drivers across clinical specialties have not been described. We performed a cross-sectional study and anonymously surveyed inpatient clinicians (nurses, advanced practice providers, and physicians) at a tertiary cancer center regarding attitudes toward unnecessary laboratory testing and its drivers across clinical specialties. A total of 837 providers completed surveys (response rate 53%). Most respondents agreed with daily testing of hospitalized patients and that daily labs generally enhance safety, and those from pediatric and surgical specialties generally valued testing less than others. Participants most commonly identified habit and institutional culture as important drivers of unnecessary testing. There were differences in other drivers across specialties, with pediatric clinicians identifying family pressure more commonly and fear of litigation less commonly compared to others. Future interventions to reduce unnecessary inpatient laboratory testing should acknowledge different attitudes based on specialty and tailor interventions accordingly. *Journal of Hospital Medicine* 2018;13:844-847. Published online first June 27, 2018. © 2018 Society of Hospital Medicine

Routine laboratory testing in hospitalized patients is common, with a high prevalence of unnecessary tests that do not contribute to patient management.[1] Excessive laboratory testing of hospitalized patients can contribute to anemia[2] and may cause patient discomfort, additional unnecessary testing resulting from false positive results, and higher out-of-pocket patient costs. Excessive testing can impact hospital budgets both directly (though direct costs are often low) and indirectly through costly downstream services and prolonged hospital stay.[3] As part of the American Board of Internal Medicine (ABIM) Foundation's Choosing Wisely initiative, several professional societies have recommended against routine laboratory testing of hospitalized adult patients.[4]

Excessive inpatient laboratory testing has been documented mostly among adult internal medicine (IM) patients with studies of drivers of unnecessary testing and efforts to reduce it conducted in IM settings.[5,6] Attitudes toward other issues related to testing overuse differ by specialty[7] and are likely to similarly vary with regard to unnecessary laboratory testing. Understanding differences in attitudes by clinical specialty is critical for framing tailored approaches to reducing inappropriate care.

We performed a cross-sectional survey of a diverse group of hospital clinicians to describe attitudes and beliefs regarding laboratory testing and its overuse across clinical specialties (eg, medical, surgical, and pediatric). We hypothesized that attitudes toward the need for testing would differ across specialties.

METHODS

Survey Development and Administration

The study was conducted at Memorial Sloan Kettering Cancer Center, a tertiary academic cancer hospital in New York City. The 12-item survey was adopted from a previously administered but not formally validated survey (Online-only Appendix).[5,8] The survey was pilot tested with four physicians, three NPs, two PAs, and three RNs and edited for content and clarity. All staff providers including NPs, PAs, RNs, and resident, fellow, and attending MDs working in the hospital during the two-week survey period (November 2-15, 2015) were eligible to participate and were emailed a link to the survey. The email invitation was resent three times during the survey period. Participants who completed the survey received a coupon for a free coffee. The study was reviewed by the Institutional Review Board and exempted from ongoing oversight.

Measures

Demographic items included clinical specialty, provider type, and gender (Appendix). The remaining survey questions included the following categories:

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TABLE 1. **Respondent Demographics (n = 837)**

Characteristic	No. (%)
Female gender	609 (73)
Clinical specialty	
Medical or Med-Onc	272 (33)
Surgical	236 (28)
Pediatric	114 (14)
Other[b]	
Critical care	73 (9)
Gynecologic	46 (6)
Neurologic	39 (5)
Other	57 (7)
Provider type[a]	
Attending MD	197 (24)
Trainee MD	
Fellow	122 (15)
Resident	17 (2)
APP	
NP	108 (13)
PA	46 (6)
RN	347 (41)

[a]Percentages do not sum to 100 due to rounding

[b]Category of "other" used in analyses for differences by clinical specialty.

Abbreviations: APP, advanced practice provider; MD, doctor of medicine; Med-Onc, medical oncology; NP, nurse practitioncer; PA, physician assistant; RN, registered nurse.

1. *Attitudes toward laboratory testing* were evaluated by threeitems about accepted norms for lab testing and two items about fears (Table 2). Responses to these items used a four-point Likert scale (strongly agree to strongly disagree).
2. *Drivers contributing to unnecessary testing* were evaluated by presenting a list of possible contributing factors (Table 2). Responses to these items used a three-point Likert scale (contributes a lot, contributes a little, or does not contribute).

Analysis

We used univariate statistics to describe demographics and survey responses. We used the chi-square statistic to evaluate differences in attitudes and drivers by clinical specialty. We dichotomized responses regarding attitudes toward lab testing ("strongly agree" and "somewhat agree" vs "somewhat disagree" and "strongly disagree.") and beliefs regarding contributing drivers ("contributes a lot" vs all others). We grouped clinical specialty into medical/med-oncology, surgical, pediatric, and other (gynecological, critical care, and other).

We used logistic regression to explore the associations between attitudes/drivers and clinical specialty after adjusting for provider type, and report the overall *P*-value. We used pediatrics as the reference group to assess direct comparisons with each of the other specialties. We performed analyses with SAS statistical software, version 9.4 (SAS Institute, Cary, North Carolina) and considered $P < .05$ to be significant.

RESULTS

Among 1,580 eligible participants, 837 (53%) completed surveys. Attending MD response rates ranged between 61% (surgical) to 86% (pediatric); rates were 59% for all trainees, 72% for PAs and 46% for RNs and NPs combined. Given privacy concerns, we were unable to collect detailed response rate information or any information about nonrespondents. The demographics are shown in Table 1.

Attitudes toward Laboratory Testing

The majority of respondents agreed that hospitalized patients should get daily labs (59%), testing on the discharge day (52%), and that daily testing generally enhances safety (55%; Table 2). Fewer pediatric and surgical clinicians endorsed that laboratory testing should be done daily (56% and 47% respectively) and enhances patient safety (46% and 47%). These differences were significant after adjusting for provider type. In addition, fewer pediatric providers endorsed the statement that daily laboratory testing helps avoid malpractice litigation. Overall, 68% of respondents agreed they would be comfortable with less testing.

Drivers Contributing to Unnecessary Laboratory Testing

The strongest drivers of unnecessary testing were seen as habit (94% responding "contributes a lot") and institutional culture (89% responding "contributes a lot"; Table 2). After adjusting for provider type, significant differences were observed based on clinical specialty. In particular, pediatric specialists were less likely to endorse fear of litigation ($P < .001$) and more likely to endorse pressure from patient/family ($P = .0003$) compared to all other specialties (Table 2, odd ratios not shown).

DISCUSSION

Overuse of laboratory testing in hospitalized patients is widely recognized in IM and likely to be prevalent in other clinical specialties. Our study elucidated differences in attitudes toward unnecessary testing and self-identified drivers across specialties in a diverse group of clinical providers at an academic cancer center. We found differences based on clinical specialty, with those caring for pediatric and surgical patients less likely than others to believe that testing should be done daily and that daily testing enhances patient safety. Furthermore, comfort with less testing was highest among pediatric specialists. Habit and institutional culture were recognized broadly as the strongest drivers of laboratory testing overuse.

Our findings regarding differences based on clinical specialty are novel. Respondents caring for pediatric patients generally placed lower value on testing, and IM clinicians were the most likely to endorse daily testing and to believe that it enhances patient safety and helps avoid malpractice litigation. The difference between adult and pediatric clinicians is surprising given the fundamental similarities between these specialties.[9] Although some resource use studies have described differences across specialties, none has examined differences in laboratory testing or examined the practice patterns of clinicians

TABLE 2. **Attitudes toward Laboratory Testing and Drivers of Unnecessary Testing by Clinical Specialty**

Question	All (n = 837)	Pediatric (n = 114)	Medical/Med-Onc (n = 272)	Surgical (n = 236)	Other (n = 215)	*P* Value[a]
Attitudes toward testing			**Strongly agree or somewhat agree, No (%)**			
Hospitalized patients should have daily laboratory testing	491 (59)	64 (56)	180 (66)	112 (47)	135 (63)	<.0001
Hospitalized patients should have laboratory testing on discharge day	434 (52)	77 (68)	158 (58)	76 (32)[b]	123 (57)b	<.0001
Daily laboratory testing generally enhances patient safety	459 (55)	53 (46)	164 (60)[b]	111 (47)	131 (61)	.0027
Daily laboratory testing generally helps avoid malpractice litigation	400 (48)	40 (35)	152 (56)[b]	98 (42)	110 (51)	.0004
Asking for laboratory testing protects me from criticism	281 (34)	31 (27)	105 (39)[b]	68 (29)	77 (36)	.0711
I would be comfortable if my hospitalized patients received LESS laboratory testing	566 (67)	86 (75)	182 (67)	157 (67)	141 (66)	.0821
Drivers of unnecessary testing			**"Contributes a lot" to ordering of unnecessary lab testing, No (%)**			
Fear of litigation	265 (32)	12 (11)	95 (35)[b]	67 (28)[b]	90 (42)[b]	<.0001
Habit or training	787 (94)	112 (98)	259 (95)	215 (91)[b]	201 (93)	.0532
Ease of ordering	683 (82)	102 (89)	223 (82)[b]	180 (76)[b]	178 (83)	.0421
Discomfort with not knowing labs	678 (81)	100 (88)	230 (85)	176 (75)[b]	172 (80)	.0110
Institutional culture	748 (89)	107 (94)	248 (91)	197 (83)[b]	196 (91)	.0046
Concern that others will ask for data	662 (79)	91 (80)	223 (82)	176 (75)	172 (80)	.3458
Pressure from patient or family	584 (70)	96 (84)	192 (71)[b]	145 (61)[b]	150 (70)[b]	.0003

[a]*P*-values based on type III analysis of effects after adjusting for provider type
[b]Significantly different odds as compared to pediatric

who are not physicians across specialties.[10] Prior studies have documented the impact of training location on practice[11,12], suggesting the importance of the local training culture.[13] As physician personalities vary across clinical specialties[14] it is likely that culture varies as well. Specialty-specific cultures are likely to strongly influence attitudes and practice patterns and warrant further exploration.

Clinicians in our sample identified drivers of unnecessary laboratory testing that were consistent with other studies, most frequently endorsing habit, followed by culture, discomfort with not knowing, and concern that someone will ask for the results.[5,15] Previous studies have focused on IM and have not included nonphysicians or compared attitudes across specialties. We found that the largest differences in drivers by specialty were related to malpractice concerns and the perception of pressure from patients or families. The low endorsement of defensive medicine among clinicians serving pediatric populations may imply that interventions to reduce unnecessary care in hospitalized children may not need to address malpractice fear. In contrast, clinicians from pediatrics identified family pressure as a greater driver of unnecessary testing. Efforts to reduce unnecessary laboratory testing in pediatrics will need to address parent expectations.

Our findings have implications for efforts to reduce unnecessary testing. Culture, identified as a key driver of testing, reflects leadership priorities, institutional history, and other factors and is difficult to specifically target. Habit, the other most-endorsed driver, is a more promising target for quality improvement interventions, particularly those addressing care processes (eg, electronic ordering). Discomfort with not knowing and fear of being asked are drivers that might be influenced by better communication about information expectations by supervising physicians and hospital administration. Lastly, education about the potential harms of excessive testing may facilitate more targeted efforts to reduce testing overuse.

Our study has important limitations. The cancer focus of the center may have influenced provider attitudes and practices. Attitudes may differ at community centers, though important differences regarding routine laboratory testing are unlikely. Second, although our sample was large, our response rate was modest at 53% and as low as 46% among RNs and NPs and we have no information regarding nonresponders. This response rate, though, was comparable to response rates seen in other large surveys.[5,15] In addition, our results reflect clinician self-report; perceptions of necessity and the true need for testing may vary across specialties and the true subconscious drivers of behavior may differ. However, differences across specialties are likely to be valid even if there are other factors at play. Self assessment of unnecessary testing may also underestimate prevalence of the problem. Finally, our findings related to driv-

ers of unnecessary testing are descriptive rather than quantitative given the lack of validated scales.

In conclusion, we evaluated attitudes toward routine laboratory testing in hospitalized patients in clinicians across specialties and found important differences. These findings speak to the diversity of cultures of medical care even within a single institution and point to the importance of studying attitudes about overused services across clinical specialties. In particular, as medical fields beyond IM increasingly recognize the importance of reducing medical overuse both in and out of the hospital, our findings highlight the importance of elucidating specialty-specific attitudes to optimize interventions to address unnecessary testing.

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Prevalence of *Staphylococcus aureus* and Use of Antistaphylococcal Therapy in Children Hospitalized with Pneumonia

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Within a cohort of >2,000 children hospitalized with community-acquired pneumonia, staphylococcal pneumonia was rare (1%) but associated with adverse in-hospital outcomes. Despite this low prevalence, use of antistaphylococcal antibiotics was common (24%). Efforts are needed to minimize overuse of antistaphylococcal antibiotics while also ensuring adequate treatment for pathogen-specific diseases. *Journal of Hospital Medicine* 2018;13:848-852. Published online first October 31, 2018. © 2018 Society of Hospital Medicine

Although *Staphylococcus aureus* pneumonia is common in children with cystic fibrosis and those with healthcare-associated infections (eg, ventilator-associated pneumonia),[1,2] *S. aureus* is an uncommon cause of community-acquired pneumonia in children. In recent years, concerns have arisen about the increasing frequency and severity of staphylococcal pneumonia, largely fueled by the emergence of community-associated methicillin-resistant *S. aureus* (MRSA).[3,4] Thus, therapy with clindamycin or vancomycin, both active against MRSA, has been recommended when *S. aureus* is suspected.[5] Given the lack of rapid and sensitive approaches to the detection of the etiologies of pneumonia, antibiotic selection is most often empirical, contributing to overuse of anti-MRSA antibiotics. In addition, resistance against these antibiotics, especially clindamycin, has been increasing.[6,7]

A better understanding of the likelihood of staphylococcal pneumonia would help to optimize empirical antibiotic selection, allowing for judicious use of antistaphylococcal antibiotics, while also avoiding poor outcomes due to delays in effective treatment when *S. aureus* is present.[8] Using data from a multicenter, population-based study of pneumonia hospitalizations in children, we sought to describe the prevalence, clinical characteristics, and in-hospital outcomes of staphylococcal pneumonia and the prevalence of antistaphylococcal antibiotic use.

METHODS

The Etiology of Pneumonia in the Community (EPIC) study was a prospective, active, population-based surveillance study of pneumonia hospitalizations among children (age <18 years) conducted between 2010 and 2012 at three children's hospitals, including two in Tennessee and one in Utah.[9] Children hospitalized with clinical evidence of pneumonia and radiographic evidence confirmed by a blinded review by study radiologists were enrolled. Etiologic assessments included blood analysis for bacterial culture, serology for eight respiratory viruses, pneumococcal and group A streptococcal polymerase chain reaction (PCR), and naso/oro-pharyngeal swabs for PCR for 13 respiratory viruses, *Mycoplasma pneumoniae*, and *Chlamydophila pneumoniae*. Data from other clinical specimens (pleural fluid, high-quality endotracheal aspirate, or quantified bronchoalveolar lavage fluid) were also recorded. For this study, we included only children with at least one bacterial culture and complete information about antibiotic use. Those with confirmed fungal pneumonia were excluded. Additional details regarding the study population and methods have been published previously.[9]

Staphylococcal pneumonia was defined based on the detection of *S. aureus* by culture (any site) or PCR (pleural fluid

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only), regardless of codetection of other pathogens. Antibiotic susceptibility profiles were used to classify *S. aureus* isolates as MRSA or methicillin-sensitive *S. aureus* (MSSA). The remaining children were classified as nonstaphylococcal pneumonia including children with other bacterial pathogens detected (classified as other bacterial pneumonia, excludes atypical bacteria), atypical bacteria, viruses, and no pathogens detected.

Use of anti-MRSA antibiotics (vancomycin, clindamycin, linezolid, doxycycline, and trimethoprim-sulfamethoxazole) and any antistaphylococcal antibiotics (anti-MRSA agents plus oxacillin, nafcillin, and cefazolin) during and after the first two calendar days of admission was identified by medical record review.

Descriptive statistics included number (%) and median (interquartile range, [IQR]) for categorical and continuous variables, respectively. Baseline clinical characteristics and outcomes were compared between children with staphylococcal versus nonstaphylococcal pneumonia, those with staphylococcal versus other bacterial pneumonia, and those with MRSA versus MSSA pneumonia using Wilcoxon rank-sum and Pearson's chi-square tests where appropriate. To account for multiple comparisons, we used a Bonferroni corrected *P* value threshold of <.001 to determine statistical significance.

RESULTS

Of the 2,358 children enrolled in the EPIC study hospitalized with radiographically confirmed pneumonia, 2,146 (91.0%) had ≥1 bacterial culture obtained. Two children with *Histoplasma capsulatum* fungal infection and six children with incomplete antibiotic utilization data were excluded, yielding a final study population of 2,138 children. Among these, blood samples were obtained from 2,134 (>99%) children for culture, pleural fluid from 87 (4%) children, bronchoalveolar lavage fluid from 31 (1%) children, and endotracheal aspirate from 80 (4%) children. Across all culture types, there were 2,332 initial cultures; 2,150 (92%) were collected within the first 24 hours.

Staphylococcal pneumonia was detected in 23 of the 2,138 children (1% [95% CI 0.7, 1.6]; 17 MRSA, 6 MSSA). Of these, 6/23 (26%) had bacteremia, 12/23 (52%) had a positive pleural fluid, and 9/23 (39%) had a positive culture from bronchoalveolar lavage fluid or endotracheal aspirate; 4/23 (17%) children had *S. aureus* detected from more than one site. Three children (13%) with *S. aureus* had a viral codetection, including two with influenza.

Compared with children with nonstaphylococcal pneumonia, those with staphylococcal pneumonia were more likely to have a parapneumonic effusion (78% vs 12%, $P < .001$), but less likely to have cough (78% vs 95%, $P < .001$). Other baseline characteristics were similar between the two groups. Children with staphylococcal pneumonia had more adverse outcomes than those without (Table), including longer median length of stay (10 vs 3 days, $P < .001$), more frequent admission to intensive care (83% vs 21%, $P < .001$), and more frequent invasive mechanical ventilation (65% vs 7%, $P < .001$). Similar findings were noted when staphylococcal pneumonia was compared with pneumonia caused due to other bacterial pathogens (n = 124). There were no significant differences in baseline characteristics or clinical course between children with MRSA and MSSA pneumonia, although the numbers were small. Overall, *S. aureus* was detected in 18/267 (7%) children with parapneumonic effusion and 19/462 (4%) children admitted to intensive care. Importantly, there were no confirmed *S. aureus* cases among children with less severe pneumonia, defined as lacking both parapneumonic effusion and intensive care admission (n = 1,488).

Overall, 519 children (24%) received antistaphylococcal therapy during their hospitalization (512/519, 99% received anti-MRSA therapy), including 22 of the 23 children with *S. aureus* detected (the only child without antistaphylococcal therapy had *S. aureus* detected from a high-quality endotracheal tube aspirate only and also had respiratory syncytial virus detected). Clindamycin was most often used (n = 266, 51%), followed by vancomycin (n = 128, 24%), clindamycin plus vancomycin (n = 83, 16%), and others (n = 42, 8%). During the first two days of hospitalization, 479 children (22%) received antistaphylococcal therapy (477 received anti-MRSA therapy). After the first two days, 351 children (16%) received antistaphylococcal therapy (346/351, 99% received anti-MRSA therapy). Use of antistaphylococcal therapy was very common in those admitted to intensive care (182/462, 39%; all but two received anti-MRSA therapy) and in those requiring invasive mechanical ventilation (103/159, 65%). Among those lacking both parapneumonic effusion and intensive care admission (n = 1,488), 232 (16%) received antistaphylococcal therapy.

DISCUSSION

In our large, population-based study of >2,000 children hospitalized with community-acquired pneumonia, *S. aureus* was identified in only 1% of children. Compared with children with other pneumonia etiologies, staphylococcal pneumonia was associated with increased disease severity. Among the small numbers studied, no differences in outcomes were found between children with MRSA and MSSA disease. Despite the low prevalence of staphylococcal pneumonia, almost one in four children received antistaphylococcal antibiotic therapy; anti-MRSA therapy was used almost exclusively.

The severity of staphylococcal pneumonia was striking, with >80% of children with *S. aureus* detected being admitted to intensive care, about 65% requiring invasive mechanical ventilation, and >75% with parapneumonic effusion. These findings are similar to those of prior retrospective studies.[4,10] The association between staphylococcal pneumonia and adverse outcomes underscores the importance of prompt institution of antimicrobial therapy targeting *S. aureus* in high-risk patients. This is noteworthy given recent epidemiological data demonstrating increases in MSSA relative to MRSA infections in children,[6] and the known superiority of beta-lactam versus vancomycin for MSSA infections, including pneumonia.[11]

Although detection of staphylococcal infection was rare, almost a quarter of children received antistaphylococcal therapy; nearly all of these children received anti-MRSA therapy. Confirming a bacterial etiology of pneumonia, however, is

TABLE. **Clinical Characteristics, Outcomes, and Antibiotic Use among Children Hospitalized with Staphylococcal and Nonstaphylococcal Community-Acquired Pneumonia**

	Staphylococcal Pneumonia			Nonstaphylococcal Pneumonia	
Characteristic	**MRSA, n = 17**	**MSSA, n = 6**	**All *S. aureus*, n = 23**	**All non *S. aureus*, n = 2,115**	**Other Bacterial[1], n = 124**
Demographics					
Age in months, median (IQR)	15 (9-55)	99 (18-170)	25 (10-66)	28 (12-73)	24 (14-64)
Male sex	12 (71)	5 (83)	17 (74)	1153 (55)	82 (66)
Race/Ethnicity					
White nonhispanic	9 (53)	4 (67)	13 (57)	818 (39)	51 (41)
Black nonhispanic	6 (35)	1 (17)	7 (30)	728 (34)	31 (25)
Hispanic	1 (6)	1 (17)	2 (9)	398 (19)	28 (23)
Other	1 (6)	0 (0)	1 (4)	171 (8)	14 (11)
Comorbidities					
Asthma/reactive airway disease	1 (6)	1 (17)	2 (9)	692 (33)	29 (23)
Other Pulmonary (excludes asthma)	1 (6)	1 (17)	2 (9)	54 (3)	2 (2)
Prematurity	1 (6)	1 (17)	2 (9)	198 (9)	9 (7)
Neurological	0 (0)	1 (17)	1 (4)	164 (8)	3 (2)
Cardiovascular	0 (0)	0 (0)	0 (0)	128 (6)	8 (6)
Genetic/metabolic	0 (0)	0 (0)	0 (0)	122 (6)	6 (5)
Other	1 (6)	0 (0)	1 (4)	123 (6)	9 (7)
Clinical Signs/Symptoms					
Illness duration in days, median (IQR)	5 (2-7)	3 (3-4)	4 (2.5-6)	3 (2-6)	4 (2-7)
Fever	16 (94)	6 (100)	22 (96)	1933 (91)	111 (90)
Cough	13 (76)	5 (83)	18 (78)	2002 (95)[3]	113 (91)
Upper respiratory symptoms[2]	13 (76)	4 (67)	17 (74)	1690 (80)	87 (70)
Shortness of breath	14 (82)	6 (100)	20 (87)	1481 (70)	85 (69)
Chest indrawing	12 (71)	3 (50)	15 (65)	1130 (53)	52 (42)
Wheezing	3 (18)	1 (17)	4 (17)	848 (40)	25 (20)
Radiographic features					
Infiltrate pattern					
Consolidation, single lobar	3 (18)	0 (0)	3 (13)	477 (23)	30 (24)
Consolidation, multilobar	10 (59)	2 (33)	12 (52)	621 (29)	51 (41)
Other infiltrate	4 (24)	3 (50)	7 (30)	857 (41)	32 (26)
Mixed	0 (0)	1 (17)	1 (4)	156 (7)	11 (9)
Parapneumonic effusion	15 (88)	3 (50)	18 (78)	249 (12)[3]	65 (52)
Clinical Course					
Hospital length of stay in days, median (IQR)	10 (6-14)	12 (8-16)	10 (7-14)	3 (2-5)[3]	7 (3-10)
Intensive care admission	14 (82)	5 (83)	19 (83)	443 (21)[3]	46 (37)[4]
Invasive mechanical ventilation	11 (65)	4 (67)	15 (65)	145 (7)[3]	25 (20)[4]
In-hospital death	1 (6)	0 (0)	1 (4)	2 (<1)[3]	0 (0)
Antibiotic use, 1st two calendar days					
Antistaphylococcal, any	15 (88)	6 (100)	21 (91)	458 (22)[3]	76 (61)
AntiMRSA	15 (88)	6 (100)	21 (91)	456 (22)[3]	76 (61)
Antibiotic use, after 1st two calendar days					
Antistaphylococcal, any	16 (94)	5 (83)	21 (91)	330 (16)1[3]	63 (51)[4]
AntiMRSA	16 (94)	4 (67)	20 (87)	326 (15)[3]	63 (51)

Data presented as no. (%) unless otherwise specified; Tests of association included Wilcoxon rank-sum and Pearson chi-squared tests where appropriate; [1]Does not include atypical bacteria; [2]Includes conjunctivitis, congestion/rhinorrhea, otalgia, and sore throat [3]Bonferroni corrected $P < .001$ comparing *S. aureus* vs. non-*S. aureus*; [4]Bonferroni corrected $P < .001$ comparing *S. aureus* vs other bacterial. Abbreviations: CAP, community-acquired pneumonia; MRSA, methicillin-resistant *S. aureus*; MSSA, methicillin-sensitive *S. aureus*.

challenging. Given the severity associated with staphylococcal pneumonia, it is not surprising that use of antistaphylococcal therapy outpaced staphylococcal detections. Antistaphylococcal therapy was especially common in those with severe pneumonia, suggesting that disease severity is an important factor that influences initial antibiotic treatment decisions. Even so, two children with MRSA detected did not initially receive anti-MRSA therapy, highlighting the challenge of balancing judicious antibiotic selection along with ensuring effective treatment. Perhaps more striking is the finding that 16% of children received antistaphylococcal therapy beyond the first two days of hospitalization, presumably after the initial culture results were available. This suggests that clinicians are reluctant to stop antistaphylococcal therapy when the etiology is unknown, although certain features, such as negative cultures, rapid clinical improvement, and lack of risk factors for staphylococcal disease, may provide important clues to support de-escalation of empiric antibiotic therapy. It is also possible that some antibiotics with antistaphylococcal activity were used for alternative indications (eg, clindamycin for penicillin allergy or concern for aspiration pneumonia).

A simple strategy for tailoring antibiotic treatment is maximizing opportunities to identify a causative pathogen. Despite the very low yield of blood cultures in children with pneumonia overall, bacteremia is more common in children with severe pneumonia and those with parapneumonic effusion, especially when cultures are obtained prior to antibiotic use.[12,13] Similarly, obtaining pleural fluid is often therapeutic and significantly improves the chances of identifying a bacterial pathogen.[14] Moreover, at least one study suggests that *S. aureus* is much less likely in cases of culture-negative parapneumonic effusions.[15] Institutional guidelines, order sets, and antimicrobial stewardship teams are also effective strategies that can facilitate judicious antibiotic use. In particular, stewardship experts can be very useful in assisting clinicians around de-escalation of therapy.[16] Use of procalcitonin, a biomarker associated with bacterial infections,[17] and prognostic tools to identify risk for adverse outcomes,[18] may also inform treatment decisions and are deserving of further study.

Our study must be considered in the light of its strengths and limitations. Analysis was derived from a population-based surveillance study of community-acquired pneumonia hospitalizations in three children's hospitals and may not be generalizable to other settings. Nevertheless, the antibiotic-prescribing practices identified in our study are consistent with those from a larger network of children's hospitals in the United States.[19] The relatively small number of children with *S. aureus* identified limited our ability to control for potential confounding factors. Some cases of staphylococcal pneumonia may not have been identified. All study children, however, were prospectively enrolled and had samples systematically collected and tested for etiology, likely leading to few cases of misclassification for this pathogen.

Our study demonstrates a very low prevalence of *S. aureus* detection among children hospitalized with pneumonia and highlights the association between staphylococcal disease and adverse in-hospital outcomes. We also document important discrepancies between disease prevalence and utilization of antistaphylococcal therapy, especially anti-MRSA therapy. Improved approaches are needed to minimize overuse of antistaphylococcal antibiotics while also ensuring adequate therapy for those who need it.

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Interventions for Frequently Hospitalized Patients and Their Effect on Outcomes: A Systematic Review

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BACKGROUND: A small subset of patients account for a substantial proportion of hospital readmissions. Programs to reduce utilization among this subset of frequently hospitalized patients have the potential to improve health and reduce unnecessary spending.

PURPOSE: To conduct a systematic review of interventions targeting frequently hospitalized patients.

DATA SOURCES: PubMed MEDLINE; Embase (embase.com); and Cochrane Central Register of Controlled Trials, January 1, 1980 to January 1, 2018.

STUDY SELECTION: Four physicians screened 4762 titles and abstracts for inclusion. Authors reviewed 116 full-text studies and included 9 meeting criteria.

DATA EXTRACTION: Study characteristics, outcomes, and details regarding interventions were extracted. Risk of bias was assessed by the Downs and Black Scale.

DATA SYNTHESIS: Out of the nine included studies, three were randomized controlled trials, three were controlled retrospective cohort studies, and three were uncontrolled pre-post studies. Inclusion criteria, interventions used, and outcomes assessed varied across studies. While all nine studies demonstrated reduced utilization, studies with lower risk of bias generally found similar reductions in utilization between intervention and control groups. Interventions commonly consisted of interdisciplinary teams interacting with patients across health care settings.

CONCLUSIONS: Interventions targeting high need, high-cost patients are heterogeneous, with many studies observing a regression to the mean. More rigorous studies, using multifaceted interventions which can adapt to patients' unique needs should be conducted to assess the effect on outcomes relevant to both providers and patients. *Journal of Hospital Medicine*. 2018;13(12):853-859. Published online first October 31, 2018. © 2018 Society of Hospital Medicine

In recent years, hospitals and health systems have engaged in considerable efforts to reduce readmissions, in part due to financial incentives from the Medicare Hospital Readmission Reduction Program.[1,2] Though efforts to improve transitions of care for all patients are laudable, risk for readmission is not distributed equally; a small subset of patients accounts for a disproportionate number of hospital readmissions.[3] This phenomenon of frequently hospitalized patients is similar to that seen in other populations in which a small proportion of patients account for a majority of healthcare utilization.[3,4]

Recognizing that the current system of healthcare delivery does not meet the needs of this population, healthcare organizations have begun to implement interventions that supplement or redesign the system of care for frequently hospitalized patients.[5-7] Descriptive reviews of ambulatory "high-need, high-cost" patients emphasize complex case management and interdisciplinary, team-based care.[8,9] Prior systematic reviews of studies aimed at patients with high use of emergency care demonstrate improvements in social outcomes such as homelessness but mixed results in reducing emergency department (ED) use.[10] However, we were unable to identify any prior reviews that evaluated interventions intended specifically for patients with frequent hospital admissions. Our objective in this systematic review was to characterize interventions for frequently admitted patients and determine whether these interventions decrease use of healthcare resources, improve health outcomes, and/or reduce costs.

METHODS

Literature Search

We registered our study protocol in the PROSPERO database. A librarian (L.O.) collaboratively developed the search strategies with other review authors (A.G., B.H., N.N.) and in January 2018 ran searches on "super users," "high utilizers," and similar

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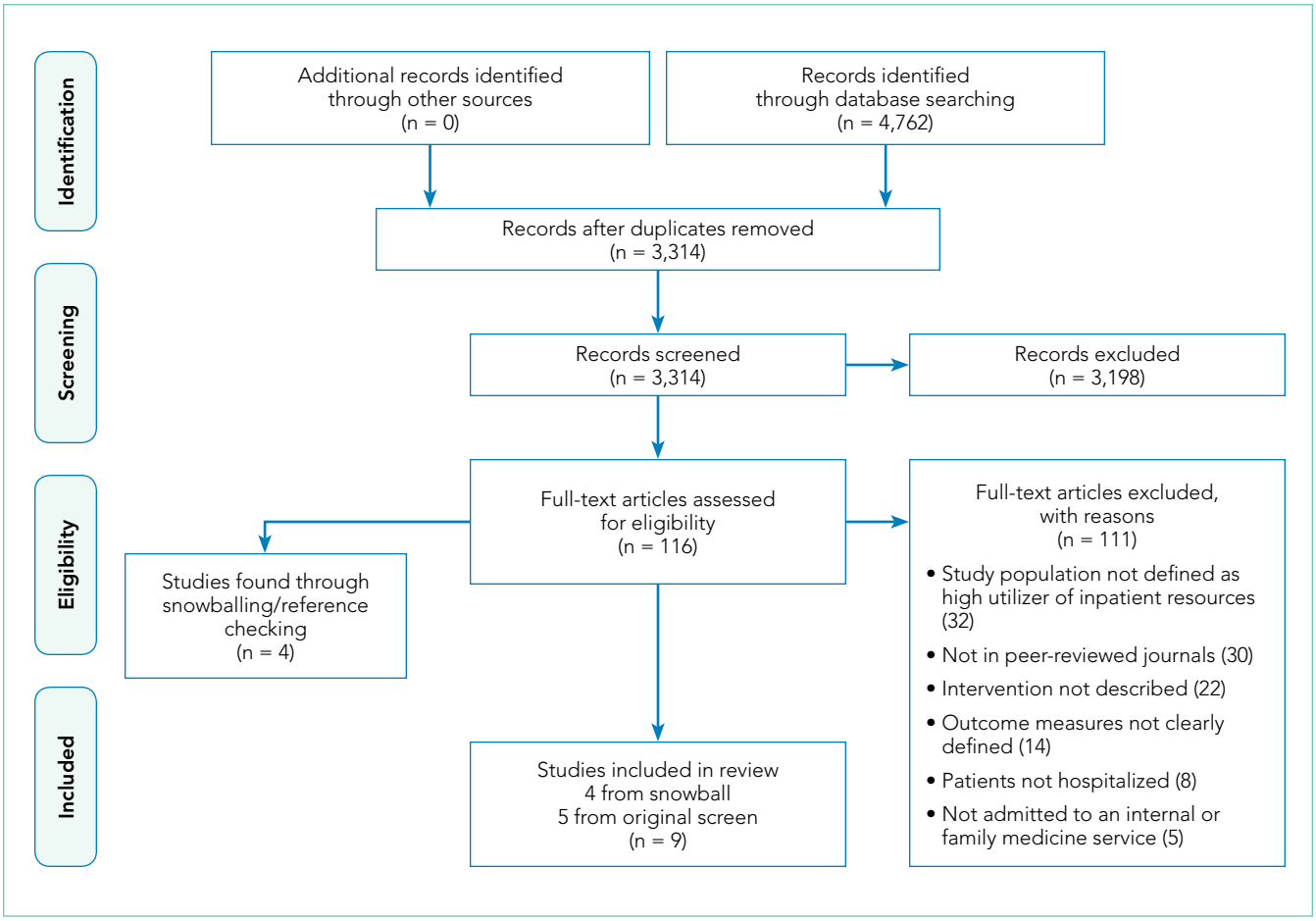

FIG. PRISMA flow diagram

terms in the following databases: PubMed MEDLINE, Embase (embase.com), and Cochrane Central Register of Controlled Trials (CENTRAL) on the Wiley platform. The complete search strategies used are available in Appendix A.

We attempted to discover additional studies by searching the reference lists of key publications and contacted authors of relevant abstracts to determine whether studies had been published or were planned for peer-reviewed publication. We also contacted authors of included studies to locate additional studies meeting inclusion criteria.

Data Collection Process

Studies were eligible for inclusion in our review if they were (1) published in a peer-reviewed source, (2) defined a study population of patients frequently admitted to inpatient medical services, (3) evaluated an intervention targeting frequently hospitalized patients, (4) included patients who were >18 years old and (5) admitted as inpatients on medical services. Of note, studies with patients admitted to psychiatric, obstetric, or surgical wards were not included, as the authors did not define these as "general medicine" units. Studies focused solely on an ambulatory population were similarly excluded. Given the heterogeneity of how studies defined frequently hospitalized patients, we did not establish a prespecified number of admissions for inclusion to ensure that we did not exclude interventions not meeting a strict set of criteria. The goal was not to examine interventions to reduce all readmissions, but rather, to look at patients who were recurrently hospitalized. Thus, patients had to be repeatedly admitted, but we let the studies define that usage explicitly.

Two members of a four-physician team (A.G., B.H., K.O., and N.N.) screened all initial results for eligibility through title and abstract review; potentially relevant articles were retained for full-text review to assess each study's eligibility. If a study's abstract did not clearly indicate whether inclusion criteria were met, we retained the article for full-text review. Two team members (A.G. and B.H.) independently reviewed the full text of each selected article to determine final inclusion in the study. The previously described inclusion criteria were again applied, and a final set of articles was identified for data extraction. Disagreements regarding inclusion in the final review (such as whether a study measured medical or psychiatric hospitalizations) were resolved through discussion among the entire four-physician review team to achieve consensus or, when required, by contacting authors of individual studies.

Data Abstraction and Risk of Bias Assessment

After selecting the final set of articles, we abstracted data us-

TABLE 1. **Overview of Study Design, Patient Population, and Results of Studies Assessing Interventions Targeting Frequently Admitted Patients**

Study	Design	Setting	Population Characteristics	N (enrolled)	N (control)	Comparison Group	Measures	Primary Outcome Results	Secondary Outcome Results
Kaufman (2014)[14]	Uncontrolled retrospective cohort	Nonprofit organization	Patients with multiple chronic conditions; 2+ inpatient admits in 6 mo.	25	N/A	None	Admissions, ED visits	63% decrease in admissions at 6 months.	51% decrease in ED visits in 6 months.
Koch (2015)[15]	Uncontrolled retrospective cohort	Single academic medical center	Patients with sickle cell disease; 5+ ED/inpatient admits in 6 mos.	115	N/A	None	Admissions, ED visits, 30-day readmissions, clinic/day hospital visits	51% decrease in admissions at 1 yr in highest utilizers (>12 admissions/yr).	No difference in admissions among entire cohort. 30-day readmissions decreased by 73% across entire cohort. ED utilization increased.
Lynch (2016)[16]	Controlled retrospective cohort	Single academic medical center	Gen med patientsts at one clinic; 2+ admissions in 6 months, 3+ ED visits in 6 months, or 2+ ED visits in 30 days.	94	77	Referred patients who did not meet enrollment criteria	Admissions, ED visits	54% decrease in admissions at 6 months versus 29% decrease in controls, (no statistical test performed).	No change in ED visits.
Mercer (2015)[17]	Uncontrolled retrospective cohort	Three hospitals within one academic network	Hospitalized patients with some degree of medical or behavioral complexity; 3+ ED/inpatient admissions in 6 mos.	24	N/A	None	Admissions, ED visits, 30-day readmissions, variable direct costs, length of stay	56% decrease in admissions at 6 months.	No change in ED visits. 36% decrease in variable direct costs.
Plant (2015)[18]	Randomized controlled trial	Single academic medical center	Genmed patients aged >70 yrs or with one chronic condition, with 3+ unplanned admissions in 12 mos.	251	249	Usual care	Readmissions, ED readmissions, quality of life.	17% decrease in admissions at 2 yrs compared with controls ($P = .07$).	No change in length of inpatient stays or quality of life.
Shah (2011)[19]	Controlled retrospective cohort	Network of county and community clinics	Gen med patients at 3 clinics; 3+ inpatient admissions, or 2+ admissions and 1 additional ED visit in 1 year.	98	160	High utilizers who declined participation	Admissions, ED visits, length of stay, ED and inpatient costs	No change in admission rate.	Significant reduction in ED visits, median inpatient days, and mean cost per year compared to control ($P < .001$ for all).
Sledge (2006)[20]	Randomized controlled trial	Single academic medical center	Patients identified from hospital database; 2+ inpatient admissions in 1 year, excluding highest cost and most complex	47	49	Usual PCP care	Admissions, ED visits, outpatient visits, total costs	31% decrease in admissions at 1 yr; same rate of decrease in controls (P=.55).	ED visits, outpatient visits, and costs similar between groups.
Weerahandi (2015)[21]	Controlled retrospective cohort	Single academic medical center	Gen med patients at one clinic; 2+ inpatient admissions in 30 days or 3+ admissions in 6 months	579	579	Matched controls receiving usual care	Admissions, ED visits, inpatient and ED costs	34% decrease in 30-day readmissions compared to controls (P <.001).	Effect remained significant at 60 days (22% reduction) but not at 180 days.
Zulman (2016)[22]	Randomized controlled trial	Single VA clinic facility	Patients at 14 VA clinics; risk for admission above 95th percentile using a risk-prediction algorithm	150	433	PCMH-modeled VA clinic patients	Cost of care, admissions, ED visits, outpatient visits, length of stay, patient surveys	31%decrease in admissions at 17 months, similar in controls.	ED visits and costs decreased at similar rates. Patients reported increased overall satisfaction with care compared to controls ($P = .04$) and had higher primary care visit rates ($P < .001$).

Abbreviations: ED, emergency department; PCMH, patient-centered medical home; VA, Veteran's Administration.

ing a tool developed by the Cochrane Effective Practice and Organization of Care Group.[11] We then compiled study-level data into a single database for reporting. Extracted elements included study design, setting, patient characteristics, inclusion and exclusion criteria, control group identification, outcome measures, results, and length of follow-up. We also extracted individual characteristics of each intervention, including common intervention elements such as intervention setting, use of health information technology resources, and whether programs developed interdisciplinary care plans. We assessed the risk of bias of each study and the quality of studies using the Downs and Black Scale.[12,13] Two team members (A.G. and B.H.) independently assessed the risk of bias for all nine studies, and differences were resolved by consensus. Due to the variation in the outcomes used, we were unable to conduct a meta-analysis.

TABLE 2. **Details of Specific Intervention Characteristics among Programs Targeting Frequently Admitted Patients**

Study	Location	Personnel	Panel Size	Electronic Patient ID	Electronic Tracking or Notification	Direct Hospital and ED Contact	Direct Outpatient Contact	Remote Care Coordination[a]	Home Visits	Care Plan	Length of intervention
Kaufman[14]	System-wide, community	Community health worker[b] nursing[c] SW [d]	25 per team	Yes	No	No	Yes	Yes	Yes	Yes	90 days
Koch[15]	Ambulatory and Hospital	Nursing, SW, clinician	115	No	No	Yes	Yes	No	No	Yes	Ongoing
Lynch[16]	Ambulatory	SW, clinician	100 per pair	Yes	No	No	Yes	Yes	No	No	Not reported
Mercer[17]	Hospital	Nursing, SW, clinician	N/A	Yes	Yes	No	No	No	No	Yes	Ongoing
Plant[18]	Hospital	Nursing	251 per team	Yes	No	Yes	No	No	No	No	Not reported
Shah[19]	System-wide, community	Care manager	Not reported	Yes	No	No	Yes	Yes	Yes	No	Variable
Sledge[20]	Ambulatory	SW with clinician consult	21	Yes	No	No	Yes	No	No	Yes	1 year
Weerahandi[21]	Ambulatory	SW	Not reported	No	No	No	No	Yes	Yes	No	35 days
Zulman[22]	Ambulatory	SW, clinician	150 per team	Yes	Yes	No	Yes	Yes	No	No	Ongoing

[a]Remote care coordination includes all appointment coordination, interdisciplinary assessment, and other telephonic or remote outreach activities.
[b]Community Health Worker includes health coaches and other staff who conduct community outreach and/or home visits.
[c]Nursing includes RN, LPN, or MA support.
[d]SW includes social workers and trained case managers.
Clinician includes physician and advanced practitioner (PA, NP) conducting direct patient care.

RESULTS

Search Results

We found a total of 4,762 references in the three databases. After de-duplication using the EndNote software, there were 3,314 references to screen. We identified 116 studies for full-text review. Of those, we selected nine studies that met the criteria for this study (Figure). The most common reason for exclusion of an article for full-text review was that the patients studied were not defined as high utilizers of inpatient resources and were instead high-utilizers of ambulatory or emergency care (32 studies). We identified five of the included studies through the primary search and four through review of the references of the included papers.

Study Designs and Included Studies

Of the nine included studies, three were randomized controlled trials, three were controlled retrospective cohort studies, and three were uncontrolled pre–post studies. The key characteristics of each study are described in Table 1.[14-22] The included studies had different definitions for patients who were high utilizers of hospital care. Eight used a "threshold" model that predicted future admissions using past patterns; these studies included patients with at least two admissions over a period of 6 to 12 months, although many had higher thresholds. Zulman et al. used a prediction algorithm to identify patients at risk of future admission. Four studies also included some measure of medical complexity, such as a certain number of chronic medical conditions;[14,17,18,22] in contrast, Sledge et al. excluded the most complex and high-cost patients.[20]

All studies measured hospital admissions as a primary or a secondary outcome (Table 1). Although all studies demonstrated a reduction in hospital admissions following implementation, those with the greatest reductions did not have a control group.[14,15,17] All three randomized controlled trials showed equal reductions in admission rates between the intervention and control groups.[18,20,22] Among those specifically examining readmissions to the hospital, similar trends emerged, although one study (Plant et al.) found a nonsignificant decrease in hospital readmissions (17% reduction in 24 months, $P = .07$).[18]

In the secondary outcome analysis, six of the nine studies found nonsignificant reductions in ED admissions (Table 1). Four studies measured costs to the hospital or the local hospital system, though none examined costs to patients or payors. Studies estimated cost differently, including the use of estimated hospital costs,[17,20] "facility patient costs" at the VA,[22] and a combination of inpatient and ED costs.[19] The latter study (Shah et al., which implemented complex case management services) was the only one to find a statistically significant decrease in mean cost per year pre- and postintervention ($20,298 versus $7,053, $P < .001$).[19]

Only one study measured the quality of life, finding no significant change in summary scores after the intervention compared with controls (93.4 versus 92, $P = .32$).[21] Another study conducted at a VA clinic network found no difference in a

patient activation scale following the intervention but found significantly increased satisfaction with overall VA care (3.16 versus 2.90, $P = .04$).[22]

Intervention Characteristics

Intervention characteristics are summarized in Table 2. Although there was heterogeneity in study interventions, we identified common themes. Five of the nine interventions[14-17,22] consisted of interdisciplinary teams that included community health workers, nurses, social workers, and physicians. Physicians were not included on every team; three interventions used them in direct care roles while two others contained physicians as advisors or in indirect roles. Intervention teams also had a variable level of involvement in a patient's care. Mercer et al. developed care plans for patients without physical interaction,[17] whereas Zulman et al. recruited patients to a separate, intensive outpatient clinic outside the usual VA care team structure.[22] The majority of interventions added direct services or support—most commonly, a social worker—to usual care processes. Patient panel sizes were relatively small, with most of the teams recruiting fewer than 150 patients per interdisciplinary team (range, 25-251). There was variation in the length of intervention, from 35 days of case management following hospital discharge to one year of intensive social work support to others of an indefinite length.[15,17,22]

Additional common themes included caring for patients across settings and incorporating information technology (IT) into workflows. Four interventions reported either interacting with patients in multiple settings, such as the hospital, clinic, and day hospital, ED, at home, or in the community.[14,19,21,22] Two others[16,20] interacted with patients only in the clinic but expanded the scope of a "traditional" primary care practice to include open scheduling, flexible appointment times, interdisciplinary visits, or outreach. In addition, IT resources assisted seven of the nine interventions, most commonly by identifying eligible patients via an electronic data tracking system or by automated alerts when their patients arrived at affiliated care locations.

Risk of Study Bias

We systematically assessed the risk of bias of the nine included studies (Appendix B). Using the scale published by Downs and Black, a point-based scale in which a score of 18 denotes a high-quality study, the studies in this review scored 15.55 on average (range 6-22, standard deviation [SD] 5.0). Four of the nine studies met the benchmark for high quality.[12,13,18-22] The risk of bias was highest for measures of internal validity and confounding (range 0-5, mean 2.83, SD 1.94). The risk of bias was lowest for reporting measures (range 0-13, mean 7.40, SD 3.43).

DISCUSSION

Overall, studies reported mixed results related to readmissions and hospital utilization. While low-quality studies found reductions in hospital use over time, higher quality studies found similar reductions in utilization between the intervention and control groups. Johnson et al. showed that frequent hospitalization rates in a cohort of high-utilizer patients declined naturally over the course of 1-2 years; only 10% of individuals in the initial cohort remained "chronically hospitalized."[6] Thus, expanding on these findings, the decline in hospitalizations over time as observed in some of the studies included in this review may be due to study patients being identified during a "spike" in utilization, which naturally decreases as the underlying medical or social factors driving rehospitalization resolve. Alternatively, reduction in hospitalizations may represent patients choosing to pursue care at other neighboring hospitals.[23] No study included in our review evaluated healthcare use at institutions other than their study hospital or health system.

A striking theme of this review was the heterogeneity in each study's patient population. Thresholds for "high utilizers" varied from two hospital admissions in six months to two to three admissions in 30 days, to a combination of ED and hospital admissions, and to the use of predictive algorithms. A standard "case definition" for this population could guide future research, enabling comparison of outcomes across settings. Thus, we propose that future studies use three or more hospital admissions within six months when evaluating interventions targeting "high utilizer" patients. Although patients with one prior hospitalization in the past year are at elevated risk of rehospitalization,[2] we feel that a higher "threshold" for this population will identify those at the highest strata of risk. Although predictive models may be better than "threshold" models, more work in validating these tools needs to be done before these can be put to use across settings.

In contrast to interventions designed to reduce readmissions for heart failure, pneumonia, or other diagnoses, frequently admitted patients do not encompass one disease or pathology pattern. Rinehart et al., in a study characterizing frequently admitted patients across a health system, identified five "subgroups" of patients, including those with (1) unstable housing, (2) comorbid medical and psychiatric illness, (3) severe complex medical illness, (4) dual-diagnosis psychiatric illness and substance abuse, and (5) a combination of medical and psychosocial barriers.[25] In light of this population's heterogeneity, interventions may need to be flexible and tailored to the needs of individual patients, while simultaneously accounting for the capabilities and priorities of the health system. More specific and standardized interventions, targeting more homogenous groups, may be appropriate for populations defined according to pathology (such as heart failure or sickle cell disease).[27]

The components of interventions used for frequently hospitalized patients were diverse. Although most of the studies used interdisciplinary teams, they focused their efforts in a variety of settings, often crossing modern "boundaries of care" by providing direct or indirect input on care across healthcare settings. Care fragmentation probably plays an important role in the risk for readmissions in this population;[9] as such, interventions that address factors across the continuum of care may be more likely to succeed.[21] Notably, six of nine studies were conducted at academic medical centers and an additional one at a VA facility affiliated with an academic center. Only two were located at community-based clinical networks, indicating

a theoretical potential for publication bias as academic centers may be more likely to study and publish their work. There may be successful interventions that have not been formally studied or published in the peer-reviewed literature.

The breadth of the outcome measures in the included studies raises questions about what metrics should define success. Although all the studies looked at hospital utilization and readmission, measure definitions varied. Importantly, a minority of studies investigated quality of life and patient satisfaction, outcomes that may ultimately provide a more fertile ground for inquiry and intervention. Two studies looked at quality of life as an outcome,[19,22] but only one found that patients reported increased satisfaction despite showing nonsignificant reductions in hospital use.[22] As shown in multiple prior studies, patient engagement is associated with increased satisfaction and can be associated with lower healthcare costs.[26,27] Hibbard et al. have demonstrated that patient activation is a specific component of patient engagement and inversely impacts healthcare cost, with lower levels of patient activation showing increased costs in comparison to those patients more engaged in their own care.[27] By focusing on changing patients' perceptions about their own health and involvement in their own care team as a partner, programs may be able to make a greater impact.

Our systematic review has several limitations. Although we used a search strategy designed to identify all relevant studies, reviewed the references of included studies, and contacted the authors, we identified only nine studies meeting our inclusion criteria. Four of the nine studies were identified from a manual review of references of the included studies, suggesting the possibility of a suboptimal search strategy. Although the inclusion of articles that appear in a check of reference lists is a valid step in the systematic review article acquisition process, we conducted a post hoc investigation of alternate search strategies. We checked the titles, abstracts, and subject headings of the four articles found by reference review to determine whether the original search could have been improved. An analysis of the articles revealed that the terminology used was not consistent with the super user/utilizer terminology we were operating under, and that the four articles used terms such as "high risk" and "complex patients," which are more generic than our targeted terms. Only on a careful read of the abstracts and full-text did we find that these articles were useful to the study. Adjusting the original search to include these general terms would have resulted in an unwieldy set of results; hence, we felt it best to adhere to our original search strategy.

Additional limitations include that only four of the nine included studies were at low risk of bias. In addition to limitations based on study design and small sample sizes, the interventions were often limited to a short period. In light of the multiple factors that contribute to frequent hospitalizations, some of which cannot be addressed quickly, studies to evaluate interventions for longer durations are warranted.

CONCLUSIONS

We found mixed results for the effect of interventions on outcomes for frequently hospitalized patients. While low-quality studies found reductions in hospital use over time, higher quality studies generally found similar reductions in utilization between the intervention and control groups. The range of definitions, interventions, and outcomes used for frequently hospitalized patients is partly explained by the heterogeneity of the population. More rigorous studies using multifaceted interventions that adapt to patients' unique needs should be conducted to assess the effect on outcomes relevant to both providers and patients.

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Acute Treatment of Hypertensive Urgency

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The "Things We Do for No Reason" (TWDFNR) series reviews practices which have become common parts of hospital care but provide little value to our patients. Practices reviewed in the TWDFNR series do not represent "black and white" conclusions or clinical practice standards but are meant as a starting place for research and active discussions among hospitalists and patients. We invite you to be part of that discussion.

CLINICAL SCENARIO

A 67-year-old man is hospitalized with community-acquired pneumonia. He has a history of hypertension and is prescribed two antihypertensive medications (amlodipine and chlorthalidone) as an outpatient. On the evening of hospital day two, he is found to have a blood pressure of 192/95 on a scheduled vital signs check. He reports no symptoms other than cough, which is not new or worsening. The covering hospitalist reviews the documented blood pressures since admission and notes that many have been elevated despite continuation of his home regimen. The patient's nurse inquires about treating the patient with additional "as-needed" antihypertensive medications.

BACKGROUND

Hypertensive crises are common in hospitalized patients, with approximately one in seven patients experiencing an episode of hypertensive emergency and/or hypertensive urgency.[1] Hypertensive emergency is typically defined as (1) a systolic blood pressure ≥180 mm Hg and/or a diastolic blood pressure ≥120 mm Hg with (2) evidence of new or worsening end-organ damage. The organs most commonly affected by severe hypertension are the brain (headache, confusion, stroke), heart (chest pain, myocardial infarction, pulmonary edema), large blood vessels (aortic dissection), and kidneys (acute hypertensive nephrosclerosis).[2] With hypertensive urgency, patients experience similarly elevated blood pressure but have no symptoms or signs suggesting acute end-organ damage. Acute treatment with intravenous (IV) or immediate-acting oral medications is common; a single-center study showed that 7.4% of hospitalized patients had an order for "as needed" IV hydralazine or labetalol, with 60.3% receiving at least one dose.[3] Among internal medicine and family medicine trainees in one survey, nearly half reported that they would use IV medications in a scenario where an inpatient had an asymptomatic blood pressure above 180 mm Hg.[4]

WHY YOU MIGHT THINK TREATING HYPERTENSIVE URGENCY IS NECESSARY

Treating patients with hypertensive urgency is based on an assumption: If one does not treat immediately, something bad (ie, end-organ damage) will occur over the next few hours. Data from the 1930s showed that patients with untreated hypertensive emergency had a one-year mortality rate >79% and a median survival of 10.4 months.[5] More recent studies suggest that the in-hospital and one-year mortality for those with hypertensive emergency are 13% and 39%, respectively.[6] These data demonstrate that patients with hypertensive emergency are at risk in both the short- and long-term.

Patients with hypertensive urgency are also at increased risk for long-term morbidity and mortality. The one-year mortality for those experiencing an episode of hypertensive urgency is approximately 9%.[6] Given the concerns about poor outcomes, it remains a common practice in many facilities to acutely lower the blood pressure in patients with hypertensive urgency. This is highlighted by recommendations of a commonly used point-of-care medical resource, which suggests that "potential legal ramifications partially motivate lowering the blood pressure over several hours."[7]

WHY TREATING HYPERTENSIVE URGENCY IS UNNECESSARY AND POTENTIALLY HARMFUL

Concerns regarding overtreatment of hypertensive urgency relate to overestimated rates of hypertensive complications, the pathophysiology of hypertension itself, and the potential for adverse events related to treatment. Given that there are few trials examining hospitalized patients with hypertensive urgency, much of the data supporting a conservative approach are drawn from studies of outpatients or emergency department patients. In addition, there is little data suggesting that outcomes are different for patients presenting with a chief complaint of hypertensive urgency and those presenting with an alternate diagnosis but who are found to have blood pressures that meet the threshold for diagnosis of hypertensive urgency.

The landmark 1967 Veterans Affairs Cooperative Trial demonstrated the long-term benefits of treating patients with chronic hypertensive urgency.[8] Importantly though, benefits

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accrued over a period of months to years, not hours. The time to the first adverse event in the placebo arm was two months, suggesting that even those with blood pressures chronically in the range of hypertensive urgency are unlikely to experience hyperacute (ie, within hours) events, even without treatment.

A more recent study, conducted by Patel et al., examined 58,836 patients seen in outpatient clinics and found to have blood pressures meeting the criteria for hypertensive urgency.[9] This study included patients whose primary issue was hypertensive urgency and patients in whom the diagnosis was secondary. A total of 426 patients were referred to the hospital and only 100 (0.17%) were subsequently admitted. At seven days, the rates of the primary outcome (a composite of myocardial infarction, stroke, and/or transient ischemic attack) were 0.1% in those sent home and 0.5% in those sent to the hospital. In those patients with a systolic blood pressure ≥220 mm Hg, two out of 977 (0.2%) of those sent home and zero out of 81 of those sent to the hospital experienced the primary outcome. These data reinforce the message that, in patients with hypertensive urgency, rates of adverse events at seven days are low, even with extreme blood pressure elevation.

The human body has adapted to withstand wide variations in blood pressure.[10] For example, through arteriolar constriction and reflex vasodilation, cerebral autoregulation maintains a constant cerebral blood flow within a wide range of perfusion pressures, ensuring that the brain is protected from higher mean arterial pressures.[11] While this process is protective, over time the autoregulatory system becomes impaired, especially in patients with cerebrovascular disease. This places patients at risk for cerebral and/or cardiac ischemia with even slight drops in perfusion pressure.[12,13] Indeed, in assessing treatment-related adverse events in a series of patients treated with intravenous nicardipine or nitroprusside for hypertensive emergency, Brooks and colleagues reported that 57% (27 of 47) of patients had overly large reductions in blood pressure (>25% reduction in mean arterial pressure) within the first 30 minutes of treatment.[14] Two patients had acute ischemic events attributed to treatment with antihypertensive medications. Myocardial infarction and stroke have both been reported,[12] and medication classes such as calcium channel blockers (sublingual nifedipine in particular), beta-blockers (eg, labetolol), angiotensin-converting-enzyme inhibitors (eg, captopril), and clonidine have all been implicated in treatment-related adverse events.[12,15-17] Another potential issue derives from the observation that blood pressures obtained in the hospital setting are often inaccurate, owing to inappropriate patient preparation, faulty equipment, and inadequate training of staff obtaining the measurement.[18]

National guidelines support a cautious approach to the treatment of hypertensive urgency. The seventh Report of the Joint National Committee on Detection, Evaluation, and Treatment of Hypertension, published in 2003, noted that "patients with markedly elevated BP but without acute target-organ damage usually do not require hospitalization, but they should receive immediate combination oral antihypertensive therapy" and that "there is no evidence to suggest that failure to aggressively lower BP in the [emergency department] is associated with any increased short-term risk to the patient who presents with severe hypertension." JNC 7 also laments contemporary terminology: "Unfortunately, the term 'urgency' has led to overly aggressive management of many patients with severe, uncomplicated hypertension. Aggressive dosing with intravenous drugs or even oral agents, to rapidly lower BP is not without risk."[19] The most recent JNC guideline does not comment on hypertensive urgency,[20] and the 2017 American College of Cardiology/American Heart Association Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults argues that, "…there is no indication for referral to the emergency department, immediate reduction in BP in the emergency department, or hospitalization for [patients with hypertensive urgency]."[21]

WHAT CLINICIANS SHOULD DO INSTEAD

After it is confirmed that a patient has no end-organ damage (ie, the patient has hypertensive urgency, not emergency), treatable causes of hypertension should be assessed. In hospitalized patients, these include missed or held doses of outpatient medications, pain, nausea, alcohol and/or benzodiazepine withdrawal, delirium, and obstructive sleep apnea.[22] If no remediable cause is identified, patients should be allowed to rest for at least 30 minutes without the administration of additional antihypertensive medications, after which time the blood pressure should be measured using the correct technique.[2] Clinical trials have shown that rest is effective at lowering blood pressure in patients with hypertensive urgency.[23,24] One study initially treated 549 emergency department patients with a 30-minute rest period, after which time 32% of patients had responded (defined as a SBP <180 mm Hg and DBP <110 mm Hg, with at least a 20 mm Hg reduction in baseline SBP and/or a 10 mm Hg reduction in DBP).[23] Another study randomized 138 patients with hypertensive urgency to either rest or active treatment with telmisartan. Blood pressures were checked every 30 minutes for four hours. The primary endpoint (reduction of MAP of 10%-35%) was similar in both groups (68.5% in the rest group and 69.1% in the telmisartan group).[24] Even if rest is ineffective, the risk-benefit ratio of acutely lowering blood pressure will typically favor withholding acute treatment in asymptomatic patients. If blood pressure remains consistently elevated, augmentation of the home regimen (eg, increasing the dose of their next scheduled antihypertensive) of oral medications may be warranted. Though not all agree with management of antihypertensives in hospitalized patients,[25] acute hospitalizations afford an opportunity to modify and observe chronic hypertension.[26]

RECOMMENDATIONS

- Ensure that patients do not have symptoms and/or signs of end-organ damage. This can be done with a brief review of systems and a physical examination. In select cases, an electrocardiogram and a chest x-ray may be warranted.
- Search for common causes of treatable hypertension in hospitalized patients; these include pain, nausea, withdrawal syndromes, and holding of usual antihypertensive medications.

- In those patients without symptoms and/or signs of end-organ damage, allow rest, followed by reassessment.
- Do not administer intravenous or immediate-acting oral antihypertensive medications to acutely lower blood pressure. Instead, address the issues raised in Recommendation #2 and consider modifying the chronic oral antihypertensive regimen in patients who are uncontrolled as outpatients or who are not treated as outpatients. Coordinate early post-discharge follow-up for repeat blood pressure evaluation and continued modification of a patient's chronic antihypertensive regimen.

CONCLUSION

Although patients with hypertensive urgency are often treated with medications to acutely lower their blood pressure, there is no evidence to support this practice, and a strong pathophysiologic basis suggests that harm may result. The patient in the case described above should be allowed to rest for at least 30 minutes, with reevaluation of his blood pressure. If it remains elevated and no treatable secondary causes are found, the treating hospitalist should consider altering his chronic antihypertensive regimen to promote long-term blood pressure control.

Do you think this is a low-value practice? Is this truly a "Thing We Do for No Reason?" Share what you do in your practice and join in the conversation online by retweeting it on Twitter (#TWDFNR) and liking it on Facebook. We invite you to propose ideas for other "Things We Do for No Reason" topics by emailing TWDFNR@hospitalmedicine.org.

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So Much More than Bald and Bloated

The approach to clinical conundrums by an expert clinician is revealed through the presentation of an actual patient's case in an approach typical of a morning report. Similar to patient care, sequential pieces of information are provided to the clinician, who is unfamiliar with the case. The focus is on the thought processes of both the clinical team caring for the patient and the discussant.

This icon represents the patient's case. Each paragraph that follows represents the discussant's thoughts.

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A 44-year-old previously healthy semiprofessional male athlete presented with five days of nausea, vomiting, and abdominal pain. He had also experienced several months of decreased energy and new episodes of constipation three weeks prior to presentation.

At this point, we do not have sufficient information to completely determine the cause of his abdominal symptoms. Common causes of abdominal pain and vomiting in adults of his age group include peptic ulcer disease, pancreatic or hepatobiliary track disorders, small or large bowel processes, appendicitis, or even renal pathology. Further characterization may be possible by describing the location and quality of pain and factors that might relieve or exacerbate his pain. Despite the ambiguity, multiple clues might allow us to narrow the broad differential diagnosis of abdominal pain. In a previously healthy, vigorous, middle-aged man with subacute abdominal pain associated with constipation, the differential diagnosis should include disease states that may cause a bowel obstruction; these states include inflammatory bowel disease (IBD), gastrointestinal malignancy, or peptic ulcer disease. Mechanical obstruction due to volvulus or intussusception would be less likely in his age group. Given his history of several months of fatigue and several weeks of constipation, he should be evaluated for metabolic causes of abdominal pain and constipation, such as hypothyroidism or hypercalcemia. In addition to basic laboratory and imaging studies, obtaining additional history regarding prior abdominal surgeries, medication use, alcohol intake, and family and travel history will be the key in directing the evaluation.

Six months prior to admission, the patient began to feel more fatigue and exercise intolerance, reduced sweating, increased cold intolerance, and increased presyncopal episodes. He was diagnosed with hypothyroidism (TSH 6.69 μIU/mL; free T4 not done) and initiated on levothyroxine. One month prior to presentation, he developed constipation, loss of taste, reduced appetite, and weight loss of 30 pounds. He developed blurry vision and photophobia. He also complained of erectile dysfunction, urinary hesitancy and straining, which were diagnosed as benign prostatic hypertrophy.

Given the addition of numerous historical features in a previously healthy man, it is important to strive for a parsimonious diagnosis to unify his seemingly disparate features. His fatigue, constipation, and cold intolerance are consistent with his diagnosis of hypothyroidism but are nonspecific. Whether the degree of hypothyroidism caused his symptoms or signs is doubtful. The constellation of symptoms and signs are more likely to be representative of a nonthyroidal illness. His abdominal pain, unexplained weight loss, and presyncopal episodes should raise consideration of adrenal insufficiency. The combination of hypothyroidism and adrenal insufficiency suggest the possibility of an autoimmune polyendocrine syndrome or other pituitary pathology. In this case, history of headache, dysgeusia, and visual disturbances might support the diagnosis of pituitary adenoma. A cosyntropin stimulation test could establish the diagnosis of adrenal insufficiency. A low ACTH level would establish a diagnosis of pituitary or hypothalamic hypofunction. If pituitary hypofunction is documented, then a brain MRI would be needed to confirm the diagnosis of pituitary adenoma.

His newly reported erectile dysfunction suggests the possibility of a psychiatric, neurologic, hormonal, or vascular process and should be explored further. Sexual dysfunction is also associated with adrenal insufficiency and hypopituitarism. However, the presence of suspected prostatic hypertrophy in a male competitive athlete in his forties also raises the question of exogenous androgen use.

His past medical history was notable for a two-year history of alopecia totalis, seasonal allergies, asthma, and a repaired congenital aortic web with known aortic insufficiency. He was married with two children, worked an office

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job, and had no history of injection drug use, blood transfusions, or multiple sexual partners. His family history was notable for hypothyroidism and asthma in several family members in addition to Crohn disease, celiac disease, diabetes, cardiovascular disease, and cancers of the breast and lung.

His past medical, surgical, and family history supports a diagnosis of autoimmune disease. Although there is a personal and family history of atopic disorders, including allergic rhinitis and asthma, no association is found between atopy and autoimmunity. His family history of hypothyroidism, Crohn disease, and diabetes suggests a familial autoimmune genetic predisposition. His history of alopecia totalis in the setting of hypothyroidism and possible autoimmune adrenal insufficiency or autoimmune hypophysitis raises suspicion for the previously suggested diagnosis of polyglandular autoimmune syndrome, also known as autoimmune polyendocrine syndrome. Type I polyglandular autoimmune syndrome is associated with hypoparathyroidism and mucocutaneous candidiasis. In the absence of these symptoms, the patient more likely has type II polyglandular autoimmune syndrome. Type II syndrome is more prevalent and can occur in the setting of other nonendocrine autoimmune disorders, such as vitiligo, myasthenia gravis, or rheumatoid arthritis. Adrenal insufficiency can be the initial and most prominent manifestation of type II syndrome.

On physical exam, he was afebrile, with a heart rate of 68 beats per minute, respiratory rate of 16 breaths per minute, and normal oxygen saturation. His supine blood pressure and heart rate were 116/72 mm Hg and 66 beats per minute, respectively, and his standing blood pressure and heart rates were 80/48 mm Hg and 68 beats per minute respectively. He was thin, had diffuse scalp and body alopecia, and was ill-appearing with dry skin and dry mucous membranes. No evidence of Osler nodes, Janeway lesions, or splinter hemorrhages were found on cutaneous examination. No Roth spots or conjunctival hemorrhages were noted on ophthalmologic examination. He had both a 3/6 crescendo–decrescendo systolic murmur best heard at the right clavicle and radiated to the carotids and a 3/6 early diastolic decrescendo murmur best heard at the left sternal border. His abdomen was slightly protuberant, with reduced bowel sounds, hyperresonant to tympanitic on percussion, and a diffusely, moderately tender without peritoneal signs. Neurologic examination revealed 8 mm pupils with minimal response to light and accommodation. The remaining portions of his cranial nerve and complete neurologic examination were normal.

The presence of postural hypotension supports the previous suspicion of adrenal insufficiency, and the possibility of a pituitary or hypothalamic process remains. However, his dilated and minimally responsive pupils and potentially adynamic bowel are inconsistent with these diagnoses. Mydriasis and adynamic bowel in combination with orthostatic hypotension, dysgeusia, urinary retention, and erectile dysfunction are strongly suggestive of an autonomic process. Endocarditis is worth considering given his multisystem involvement, subacute decline, and known valve pathology. The absence of fever or stigmata of endocarditis make it difficult to explain his clinical syndrome. An echocardiogram would be reasonable for further assessment. At this point, it is prudent to explore his adrenal and pituitary function; if unrevealing, embark on an evaluation of his autonomic dysfunction.

Initial laboratory investigations were notable for mild normocytic anemia and hypoalbuminemia. His cosyntropin stimulation test was normal at 60 minutes. An abdominal CT scan demonstrated marked dilation in the small bowel loops (6 cm in caliber) with associated small bowel wall thickening and hyperemia. The echocardiogram was unrevealing and only confirmed the ongoing, progression of his known valve pathology without evidence of vegetation.

The above testing rules out primary adrenal insufficiency, but an appropriate response to the cosyntropin stimulation test does not rule out secondary, or pituitary, adrenal insufficiency. The echocardiogram and lack of other features make infective endocarditis unlikely. Thus, as mentioned, it is important now to commence a complete work-up of his probable dysautonomia to explain the majority of his features. Additionally, his hypothyroidism (if more than sick euthyroid syndrome), family history of autoimmune processes, and alopecia totalis all suggest the possibility of an immune-related syndrome. His CT scan revealed some thickened hyperemic bowel, which could suggest an IBD, such as Crohn disease; however, the absence of other signs, such as fever, diarrhea, or bloody stools, argues against this diagnosis. A syndrome that could unify his presentation is autoimmune autonomic ganglionopathy (AAG), a rare genetic autonomic system disorder that presents with pandysautonomia. The spectrum of autoimmunity was considered early in this case, but the differential diagnosis included more common conditions, such as adrenal insufficiency. Similarly, IBD remains a consideration. The serologic studies for IBD can be useful but they lack definitive diagnostic accuracy. Given that treatment for AAG differs from that for IBD, additional information will help guide the therapeutic approach. Anti-α3gnAChR antibodies, which are associated with AAG, should be checked.

His history of presyncope, anhidrosis, urinary retention, and ileus raised suspicion for pandysautonomia, as characterized by signs of sympathetic and parasympathetic dysfunction. The suspicion for pandysautonomia was confirmed via specialized autonomic testing, which included reduced heart rate variation on Valsalva and deep breathing maneuvers, orthostatic hypotension consistent autonomic insufficiency on Tilt table testing, and reduced sweat response to acetylcholine application (QSART test). The patient underwent further diagnostic serologic testing to differentiate causes of autonomic failure (Table 1). His personal and family history of autoimmunity led to the working diagnosis of AAG. Ultimate testing revealed high

TABLE 1. **Diagnostic Considerations for Autonomic Failure Correlated with Patient's Findings**
Overview adapted from Benarroch E. The clinical approach to autonomic failure in neurological disorders. Nat Rev Neurol. 2014;10(7):396-407. doi: 10.1038/nrneurol.2014.88.[8]

Approach to Autonomic Failure and Patient's Clinical Findings			
		Patient Study & Clinical Findings	
Categories	**Disorders**	**Study**	**Findings**
Neurodegenerative Disorders	• Multiple System Atrophy • Lewy Body Disorders ○ Parkinson disease ○ Dementia with Lewy bodies • Others ○ Familial leukoencephalopathies ○ Prion disorders	History and Exam: • normal neuro exam (without masked facies, abnormal tone or rigidity, or shuffling gait) • no cognitive impairment • no family history of neurocognitive disorders	
Peripheral Neuropathies	• Chronic Sensorimotor Neuropathies ○ Diabetes ○ Amyloidosis ○ Metabolic	• HbA1c • Rectal biopsy • Vitamin B12 • Urine heavy metals • BUN/Creatinine	5.8% Negative Congo Red 1332 pg/mL [ref 190-910 pg/mL] Negative 15 mg/dL / 0.68 mg/dL
	• Sensory Ganglionopathies ○ Sjögren syndrome ○ Paraneoplastic neuropathy	• ANA • dsDNA • ENA panel* • Paraneoplastic panel • UPEP/SPEP	+1:80 speckled pattern Negative Negative Negative Normal
	• Distal Painful Neuropathies ○ Sodium channelopathies ○ Infectious ○ Hereditary	• RPR • HIV • HCV Antibody	Nonreactive Negative Negative
	• Acute/Subacute Motor Polyradiculopathy ○ Guillain-Barré syndrome ○ Porphyria	History and Exam: • progressive weakness and areflexia not present • no family history of porphyria, no skin findings, no seizure history, no cognitive changes	
Isolated Autonomic Failure Syndromes	• Progressive ○ Pure autonomic failure • Acute or Subacute ○ Paraneoplastic autonomic neuropathy ○ Autoimmune autonomic ganglionopathy	• UPEP/SPEP • PSA • Chest-Abdomen CT • PET Scan • Bone Marrow biopsy • Colonoscopy • Paraneoplastic panel • Ganglionic nicotinic ACh receptor antibody	Normal 0.55 ng/mL [ref 0.00-4.00 ng/mL] No malignancy Increased bone marrow signal Normal Normal with normal biopsies Negative 3.29 nmol/L [ref <0.02 nmol/L]

*ENA panel includes: anti-Ro (anti-SSA), anti-La (anti-SSB), anti-Sm, anti-RNP, anti-Jo-1, anti-Scl70, anticentromere

titers of autoantibodies, specifically anti-α3gnAChR (3.29 nmol/L, normal <0.02 nmol/L), directed against the ganglionic nicotinic acetylcholine receptor. This finding strongly supported the diagnosis of AAG.[1,4-7]

He was initially treated empirically with intravenous immunoglobulin (IVIG) with minimal improvement. He received additional immunomodulating therapies including methylprednisolone, plasmapheresis, and rituximab but did not tolerate a trial of mycophenolate. Six weeks after therapy initiation, his antibody titers decreased to 0.89 nmol/L with associated clinical improvement. Ultimately, he was discharged from the hospital on day 73 with a feeding tube and supplemental total parenteral nutrition. Four months postdischarge, he had returned to his prediagnosis weight, had eased back into his prior activities, and was off supplemental nutrition. Over a year later, he completed a 10-month prednisone taper and continued to receive monthly IVIG infusions. His symptoms were well controlled, and he reported perspiration with exercise, good oral intake, no photophobia or orthostasis, and was able to return to work.

DISCUSSION

The clinical approach to dysautonomia is based on different etiologies: (1) those associated with neurodegenerative disorders; (2) those associated with peripheral neuropathies, and (3) isolated autonomic failure.[2] Thus, clinical history and physical examination can assist greatly in guiding the evaluation of patients. Neurodegenerative disorders (such as Parkinson disease), combined disorders (such as multiple-system atrophy), and acquired or familial processes were considered.

TABLE 2. **Autonomic Failure Overview: Signs and Symptoms**

Nervous System Involvement	Clinical Manifestations
Sympathetic Nervous System	orthostasis syncope anhidrosis
Cranial Parasympathetic Nervous System	xerophthalmia xerostomia impaired pupillary constriction blurry vision photophobia
Sacral Parasympathetic Nervous System	erectile dysfunction urinary retention
Enteric Nervous System	gastroparesis constipation neurogenic bowel obstruction dysgeusia

Our patient had neither a personal or family history nor physical examination supporting a neurodegenerative disorder. Disorders of the peripheral nerves were considered and can broadly be categorized as chronic sensorimotor neuropathies, sensory ganglionopathies, distal painful neuropathies, and acute or subacute motor polyradiculopathies. During evaluation, no historical, physical examination, or laboratory findings supported diabetes, amyloidosis, heavy metals, Sjögren syndrome, paraneoplastic neuropathy, sodium channel disorders, infectious etiologies, or porphyria (Table 1). Thus, in the absence of supportive evidence for primary neurodegenerative disorders or peripheral neuropathies, his syndrome appeared most compatible with an isolated autonomic failure syndrome. The principal differential for this syndrome is pure autonomic failure versus an immune-mediated autonomic disorder, including paraneoplastic autoimmune neuropathy and AAG. The diagnosis of pure autonomic failure is made after there is no clear unifying syndrome after more than five years of investigation. After exploration, no evidence of malignancy was discovered on body cross sectional imaging, PET scanning, bone marrow biopsy, colonoscopy, or laboratory testing. Thus, positive serologic testing in the absence of an underlying malignancy suggests a diagnosis of AAG.

AAG was first described in 1969 and is a rare, acquired disorder characterized by combined failure of the parasympathetic, sympathetic, and enteric nervous systems. This disorder typically presents in young-to-middle aged patients but has been described in all age groups. It is more commonly seen in patients with coexistent autoimmune diseases and/or a history of familial autoimmunity. The onset of clinical AAG may be subacute (less than three months) or insidious (more than three months). Patients present with signs or symptoms of pandysautonomia, such as severe orthostatic hypotension, syncope, constipation and gastrointestinal dysmotility, urinary retention, fixed and dilated pupils, and dry mouth and eyes (Table 2). Up to 40% of patients with AAG may also have significant cognitive impairment.[3,4] Diagnosis relies on a combination of typical clinical features as discussed above and the exclusion of other diagnostic considerations. Diagnosis of AAG is aided by the presence of autoantibodies to ganglionic nicotinic acetylcholine receptors (gnAChR), particularly antiganglionic acetylcholine receptor α3 (anti-α3gAChR).[1] Anti-gnAChR antibodies are only present in about half of patients with AAG. Antibody titers are highest in subacute AAG (40%-50%)[3] compared with chronic AAG (30%-40%) or paraneoplastic AAG (10%-20%).[5] Anti-gnAChR antibodies are not specific to AAG and have been identified in low levels in up to 20% of patients with thymomas, postural orthostatic tachycardia syndrome, chronic idiopathic anhidrosis, idiopathic gastrointestinal dysmotility, Lambert–Eaton syndrome, and myasthenia gravis without thymoma.[1,5-7] These associations raise the question of shared pathology and perhaps a syndrome overlap. Individuals with seropositive AAG may also have other paraneoplastic antibodies, making it clinically indistinguishable from paraneoplastic autonomic neuropathy.[5,8] Although the autoantibody lacks sensitivity and is imperfectly specific, its presence supports a diagnosis of AAG. Anti-gnAChR antibodies have been shown to be pathological in rabbit and mouse models.[4] In patients with AAG, higher autoantibody titers correlate with increased disease severity.[1,6,7] A decrease in autoantibody titers correlates with decreased disease severity.[6] Case report series also described a distinct entity of seronegative AAG.[2,3] Maintaining a high clinical suspicion for AAG even with negative antibodies is important.

Given the rarity of the disease, no standard therapeutic regimens are available. About one-third of individuals improve on their own, while other individuals require extensive immunomodulation and symptom management. Case series and observational trials currently make up the vast array of treatment data. Therapies include glucocorticoids, plasmapheresis, IVIG, and other immunosuppressive agents, such as rituximab.[9-12] Patients with and without identified anti-gnAChRs antibodies may respond to therapy.[12] The overall long-term prognosis of the disease is poorly characterized.[9,10,13]

Despite the rarity of the syndrome discussed, this case represents how diagnostic reasoning strategies, such as law of parsimony, shift how the case is framed. For example, a middle-aged man with several new, distinctly unrelated diagnoses versus a middle-aged man with signs and symptoms of autonomic failure alters the subsequent clinical reasoning and diagnostic approach. Many diseases, both common and rare, are associated with dysautonomia. Therefore, clinicians should have an approach to autonomic failure. This case provided an opportunity to discuss the clinical manifestations of dysautonomic syndromes; review the clinical features, diagnostic approach, and management of the rare entity of AAG; and demonstrate how the early application of the "law of parsimony" may assist in unifying complex clinical syndromes.

TEACHING POINTS

- Recognize the following signs and symptoms suggesting a dysautonomic syndrome: orthostasis, syncope, anhidrosis,

xerophthalmia, xerostomia, impaired pupillary constriction, blurry vision, photophobia, erectile dysfunction, urinary retention, gastroparesis, constipation, neurogenic bowel obstruction, and dysgeusia.

- Recognize the clinical features, diagnostic approach, and management of autoimmune autonomic ganglionopathy.
- When faced with a complex clinical presentation, early application of the "law of parsimony" may help identify a unifying syndrome.

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Patients and families can obtain additional information online at http://www.rarediseasesnetwork.org/cms/autonomic/Learn-More/Disorder-Definitions#AAG via the Autonomic Disorders Consortium on Rare Clinical Diseases Research Network. An additional resource is Dysautonomia International at http://www.dysautonomiainternational.org/page.php?ID=124.

A Model to Improve Hospital-Based Palliative Care: The Palliative Care Redistribution Integrated System Model (PRISM)

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Many hospitalized patients have unmet palliative care needs that are exacerbated by gaps in the palliative care subspecialty workforce. Training frontline physicians, including hospitalists, to provide primary palliative care has been proposed as one solution to this problem. However, improving palliative care access requires more than development of the physician workforce. System-level change and interdisciplinary approaches are also needed. Using task shifting as a guiding principle, we propose a new workforce framework (the Palliative care Redistribution Integrated System Model, or PRISM), which utilizes physician and nonphysician providers and resources to their maximum potential. We highlight the central role of hospitalists in this model and provide examples of innovations in screening, workflow, quality, and benchmarking to enable hospitalists to be purveyors of quality palliative care. *Journal of Hospital Medicine* 2018;13:868-871. Published online first August 29, 2018. © 2018 Society of Hospital Medicine

Palliative care is an essential component of inpatient medicine. At its core, it is an interdisciplinary philosophy of care aiming to achieve the best quality of life for patients and families in the physical, psychosocial, and spiritual domains. With the aging population and growing complexity of hospitalized patients, inpatient palliative care needs are only projected to rise. However, a mismatch exists between the number of palliative care–trained physicians and the demand for such physicians. Currently, only 6,600 US physicians are board certified in palliative care—just 37% of the projected need.[1] These workforce shortages have serious implications. In fact, it is estimated that nearly 40% of all hospitalized patients who need palliative care go without it.[2]

Existing efforts to improve access to palliative care have largely focused on bolstering the palliative care workforce. One tactic particularly relevant to hospitalists centers on frontline physicians providing "primary" palliative care: basic symptom management, patient-centered communication, and goals of care assessment, regardless of the disease state.[3] Such physicians constitute the base of today's palliative care workforce model—a three-tiered pyramid built on clinician availability and skills. In this model, the second tier ("secondary" palliative care) includes physicians supported by a palliative care consultant or referral. The third level ("tertiary" palliative care) encompasses care provided directly by specialized palliative care teams, usually within academic medical centers (Figure 1).[4]

The practice of primary palliative care is central to the practice of hospital medicine.[5,6] After all, hospitalists generate nearly half of all inpatient palliative care consultations[7] and routinely interface with social workers, pharmacists, nurses, chaplains, and other consultants in their daily activities. Consequently, they are also well versed in serious illness communication and prognostication.[8] In many ways, they are ideal purveyors of palliative care in the hospital.

Why then does the challenge to meet the demands of patients with palliative care needs persist? The truth may lie in at least three central shortcomings within the tiered palliative care workforce model. First, physicians comprising the base (where hospitalists typically fall) possess variable skills and knowledge in caring for seriously ill patients. While training opportunities exist for interested individuals,[7] education alone can rarely achieve a systematic change. Second, some physicians may have the requisite skills but lack the time or resources to address palliative care needs.[8] This is particularly true for inpatient clinicians who face pressures related to throughput and relative value units (RVUs). Third, the tiered approach is highly physician-centric, ignoring nonphysicians such as nurses, chaplains, and social workers outside of traditional palliative care subspecialty teams – members who are integral to the holistic approach that defines palliative medicine.

THE PALLIATIVE CARE REDISTRIBUTION INTEGRATED SERVICE MODEL (PRISM)

To better address the current palliative care access problem, we propose a new model: "The Palliative care Redistribution Integrated Service Model (PRISM; Figure 1)." Using the industrial engineering principle of "task shifting," this approach leverages disciplinary diversity and shifts specific activities from more specialized to less specialized members.[9] In this way, PRISM integrates hospital-based interdisciplinary teams across all tiers of palliative care delivery.

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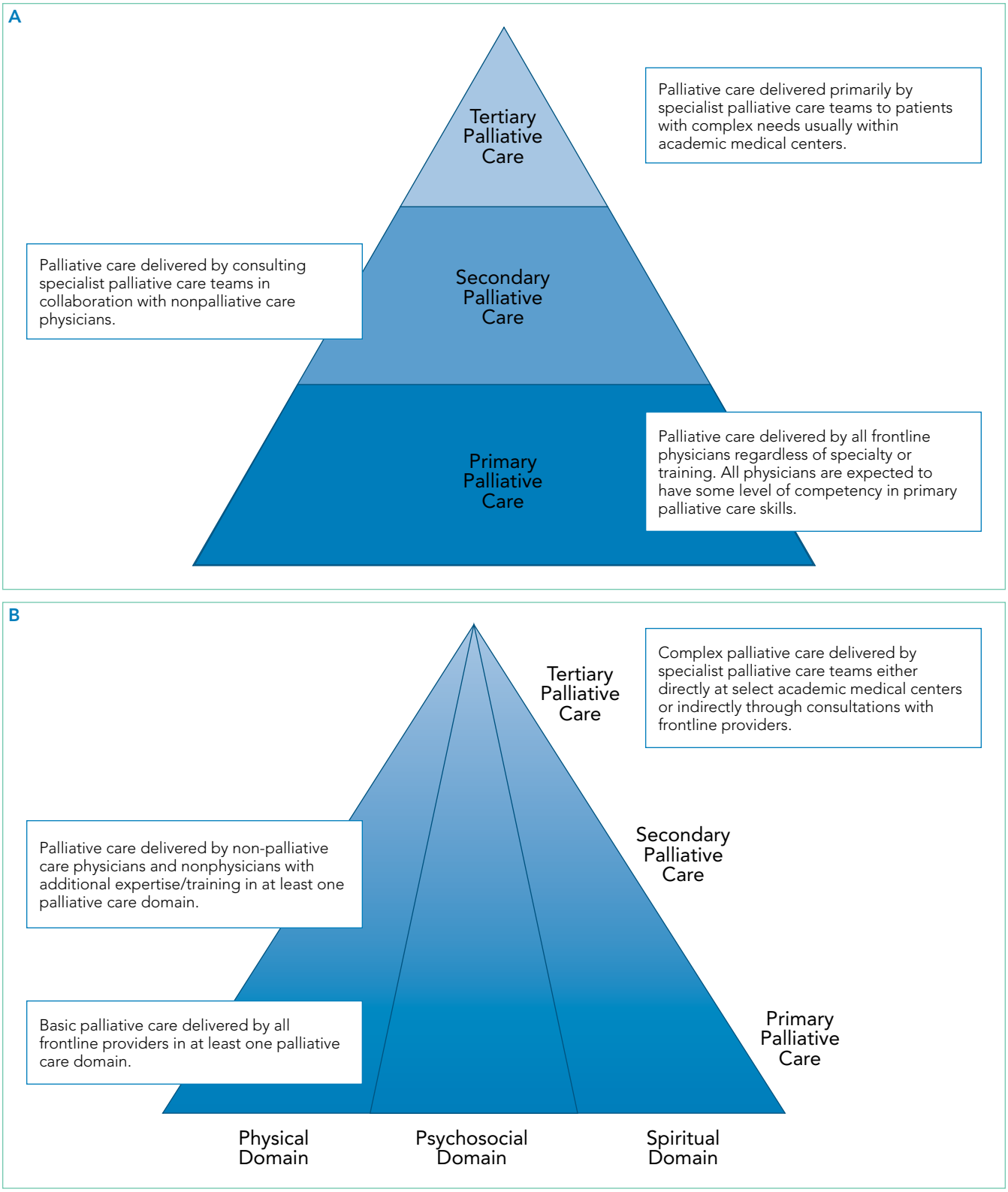

FIG 1. (A) The current 3-tiered pyramid model of palliative care workforce. (B) Palliative Care Redistribution Integrated System Model (PRISM): a new palliative care workforce model emphasizing task-shifting within three domains of palliative care—physical, psychosocial, and spiritual care.

PRISM sheds a tier-based approach in favor of flexible, skill-based verticals that span all physician and nonphysician providers. By dividing the original pyramid into three domains—physical, psychosocial, and spiritual—providers with various spheres of expertise may serve patients on multiple tiers. For example, a bedside nurse may perform basic psychosocial as-

sessment consistent with his or her training, while physicians may focus on code status or prescribe antiemetics or low-dose opiate monotherapy—skills they have refined during medical school. Analogously, secondary palliative care may be delivered by any provider with more advanced skills in communication or symptom management. In this way, we expand the pool of clinicians available to provide palliative care to include nurses, hospitalists, oncologists, intensivists, social workers, and chaplains and also recognize the diversity of skill sets within and between disciplines. Thus, a hospitalist may clarify the goals of care but may ask a social worker trained in psychosocial assessment for assistance with difficult family dynamics or a chaplain for spiritual needs. Interdisciplinary teamwork and cross-disciplinary communication—hallmarks of palliative care—are encouraged and valued. Furthermore, if providers feel uncomfortable providing a certain type of care, they can ask for assistance from more experienced providers within their discipline or outside of it. In rare cases, the most complex patients may be referred to specialist palliative care teams.

Inherent within PRISM is a recognition that all providers must have a basic palliative care skillset obtained through educational initiatives.[7] Yet focusing solely on training the workforce as a strategy has and will continue to miss the mark. Rather, structural changes to the means of providing care are also needed. Within hospitals, these changes often rely heavily on hospitalists due to their central position in care delivery. In this way, hospitalists are well primed to be the agents of change in this model.

The Role of Technology

Since many hospitalized patients have unrecognized and underserved palliative care needs, a formal approach to assessment is needed. Lin *et al*. proposed criteria for a "sentinel hospitalization," marking a major illness or transition in high-risk patients necessitating palliative interventions.[10] Similar screening criteria have been validated among hospitalized oncology patients[11] and in critical care.[12] While checklists have been shown to help identify hospitalized patients with palliative care needs,[13] their implementation has been slow, presumably because they are burdensome for busy providers to complete.

Technological automation may be a solution to the checklist conundrum. For example, if palliative care screening criteria could be automatically extracted from electronic health records, scoring systems could trigger hospitalists to consider the goals of care discussions or engage an interdisciplinary care team to fulfill a variety of needs. Frameworks for such scoring systems already exist and are familiar to most hospitalists. For example, admission order sets routinely calculate the Padua or Caprini score to facilitate decision-making for prophylaxis of deep vein thrombosis. An admission order set that screens and prompts decision-making around palliative care needs is thus feasible. One example is a hard stop for entering code status in the admission order set; in turn, this hard stop could also trigger providers to complete a "check-box" palliative care screening checklist. Automatic extraction of certain data from the record—such as age, prior code status, recent hospitalizations, or mobility scores—could auto-populate to facilitate decision-making. In turn, measuring the influence of such tools on access to palliative care, workflow, and capacity will be important, as most tools may not have quality or value intended.[14]

Streamlining Workflow

It is common for hospitalists to oversee care for 15-20 patients at a time. Thus, they may not have the time to meaningfully engage patients to assess palliative care needs. Creating designated hospitalist palliative care teams with enhanced interdisciplinary support for patients identified using sentinel hospitalization or checklist-based tools may help to solve this dilemma. These teams may also employ lower "caps," freeing up time for critical discussions and planning around end of life. At the University of Michigan, we are planning just such an approach, a strategy which has the additional benefit of bypassing the binary "care versus no care" dilemma faced by patients choosing palliation. Rather, patients may continue to receive treatments congruent with the goals of care in such teams.

Making Palliative Care a Standard of Care

A call for health systems to develop and implement palliative care quality metrics has emerged. Given their role in quality improvement and health system reform, hospitalists are well positioned to shepherd this imperative. Creating incentives to screen inpatients for palliative care needs and develop new homes in which to care for these patients are but a few ways to help set the tone. Additionally, developing and sharing quality metrics and benchmarks currently captured in repositories such as the Palliative Care Quality Network, Global Palliative Care Quality Alliance, and Center to Advance Palliative Care can help to assess and continually improve care delivery. Creating and sharing dashboards from these metrics with all providers, regardless of discipline or training, will ensure accountability to deliver quality palliative care.

CONCLUSION

Many hospitalized patients do not receive appropriate attention to their palliative care needs. A new interdisciplinary workforce model that task shifts to physician and nonphysician providers and pairs system-level innovations and quality may solve this problem. Input and endorsement from a wide variety of disciplines (particularly our nonphysician colleagues) are needed to make PRISM operational. The proof of concept will lie in testing feasibility among key stakeholders and rigorously studying the proposed interventions. Through innovation in technology, workflow, and quality improvement, hospitalists are well poised to lead this change. After all, our patients deserve nothing less.

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Barriers to Earlier Hospital Discharge: What Matters Most?

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"Every system is perfectly designed to get the results it gets."
—W. Edwards Deming inspired quote[1]

The timing of patient discharge represents a Gordian knot in hospital operations. Moving the time of discharge to earlier in the day is a complex challenge that defies replicable solutions and is often a barrier to optimal throughput and patient experience. In this issue of the *Journal of Hospital Medicine*, Zoucha et al. identify that discharge orders are frequently delayed due to physicians caring for other patients, heterogeneity in physician rounding styles, and other intrinsic factors such as census size, rounding style, and teaching versus nonteaching services.[2] Some of these factors and their negative impact are consistent with the effect of higher hospitalist workload (census) when increasing length of stay that was identified by Elliott et al.[3] Others, such as rounding style and balancing teaching and education, are a part of many hospitalist service operations. Other intrinsic factors identified by the authors include awaiting consultant recommendations, care completion by social workers, procedures, labs, radiology, therapy services, and home oxygen.

The authors, however, recognize hospitalist behaviors and hospital operations as intrinsic factors. This is significant because intrinsic factors are theoretically under the control of the hospital's physicians, administration, and support services. They lend themselves to continuous improvement, re-engineering, and change management. They are a direct result of the people, processes, structure, and supporting information technology (IT).

The findings of this study contrast with the perceived dominance of extrinsic factors such as awaiting a ride, insurance authorization issues, or placement as the cause for discharge delays. Anecdotally, physicians and nurses in organizations often identify such extrinsic factors as causes of discharge delays before they call out intrinsic factors.

Frequently, the first reaction to managing complex intrinsic constraints is to add resources and complexity. Continuous improvement often reveals the culprit is poor design and waste found throughout the system. Zoucha et al. refer to LEAN successes by others[4] as an example of how to approach these complex intrinsic issues. Increasing early discharge with improvement in length of stay and reducing or maintaining the readmission rate has been achieved using the Institute for Healthcare Improvement Model for Improvement,[5] the Red/Yellow/Green Discharge Tool within the electronic medical record,[6] and a comprehensive management plan.[7] These examples were often accomplished through improving the deployment of existing resources and reducing wasted activity. New predictive tools using supervised machine learning can help identify appropriate patients for discharge earlier in the day.[8] This approach is built on the concepts of "efficiency and communication as components of quality healthcare delivery."[6]

Perhaps a practical reductionist approach is to start with the end in mind, and ask the question "what matters most?" Three key times occur in each discharge and the authors capture two of these: the discharge order time and discharge time. Not captured is the time the patient and family are *told* they are being discharged. It is against this backdrop that we can look at four perspectives: caregiver, organization, community, and the patient and family. "What matters most?" depends on the perspective of each one of the parties involved.

From the perspective of the caregivers (physicians and residents), the conclusions support prioritizing rounding on patients ready to discharge, lowering team census, and restructuring teaching rounds to drive earlier discharges. But only 7% of encounters prioritized patients ready for discharge first. Seventy-six percent prioritized sickest patients first (33%), room-by-room (27%), and newest patients (16%).[2] The authors emphasize that such an approach needs to be balanced against the needs of the entire team census to ensure optimal care for all patients. Team and individual hospitalist census and processes must be optimized to improve the efficiency and effectiveness of the work. For teaching services, the goal is to accomplish effective teaching while maintaining or improving throughput. When addressing optimal census, Wachter concludes "the right census number will be the one in a given setting that maximizes patient outcomes (and in a teaching hospital, educational outcomes as well), efficiency, and the satisfaction of both patients and clinicians, and does so in an economical way."[9]

Healthcare is delivered by teams. As we look at supporting and structuring our hospitalist teams' inpatient rounding we need to include the contributions of advanced practice professionals, pharmacists, nurses, care managers, social workers, and others. Achieving a team focus on a goal can be support-

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ed by number-by-time (n-by-T) target initiatives, which have been used successfully.[10,11] Team-based solutions must be developed to address these complex issues and in recognition of the need to distribute this responsibility across the system, not just depending on physician changes to ensure optimal outcomes.

The perspectives of organization and community have the common goals of delivering healthcare value (outcomes, quality, safety, and sustainability) and ensuring access. To achieve these, it is important to separate the discharge curve (by shifting these patients' time of discharge to the left) from the arrival curve, which is more fixed. The organization and community benefit from reduced cost of care, improved value delivery, and better access to services. For hospitals and health systems facing high occupancy, this becomes important for access and serving the community, especially during the peak hours for admissions and discharges.

Against this backdrop is the most important perspective, which is that of the patients and families. What matters most to them? When does their clock start? For patients and families, we believe that their expectations begin when the physician or APP says, "you are doing well and we can get you home today." In the current study, the median time to discharge from the discharge order for four of the five hospitals was about three hours.[2] It is reasonable to assume the time interval is on the order of four to six hours or more for many patients. Is this acceptable? We have little data to answer this question directly, and while the Hospital Consumers Assessment of Healthcare Providers and Systems (HCAHPS) survey asks select questions regarding the effectiveness of discharge information, it is silent on matters of discharge timeliness and expectations. While on the administrative side we often use readmission rates as a proxy for a safe and "effective" discharge, in reality, we lack meaningful patient-reported outcome measures to assess our effectiveness, which is a necessity for performance improvement.

The opportunities for improvement suggested by this study include restructuring rounding to prioritize discharges, managing census per provider, and rethinking resident education to accommodate both education and service. The authors' approach includes identifying ways to improve the efficiency of the work through other team members (such as pharmacy techs for medication reconciliation) and balancing ancillary services support for all inpatient care and the outpatients they serve. Alternatively, tying incentives to the goal could be a convenient leadership response. The 2016 Society of Hospital Medicine State of Hospital Medicine Report notes that more than half (54%) of nonacademic hospitalist groups that treat adults have an incentive tied to early morning discharge orders or times. We believe that by keeping the patients and families at the center of this discussion, we are more likely to accomplish the goal of improved safety, efficiency, effectiveness, and patient experience.

The literature supports discharge delays as an international challenge with research on the topic in healthcare systems across the world.[12] This may be related to an aging population, improvements, and access to advanced healthcare, and the challenges of occupancy and capacity mismatches in many healthcare systems worldwide. The authors have identified important intrinsic factors for these throughput and discharge delays. The results beg the question, are we willing to do the redesign and behavior change in our delivery of healthcare and healthcare education to achieve a more optimized system of care delivery?

A now-retired Cleveland Clinic performance improvement engineer frequently referenced W. Edwards Deming on "what makes the biggest difference in improving internal service quality?" He distilled this to two axioms based on Deming's work: reducing cycle time and reducing defects. Both must be accomplished from the customer's (patient's) perspective without tradeoffs between the two. Cycle time is the time to accomplish a completed process or action, such as patient discharge or LOS. Defects are all the waste or "impossible" challenges that contribute to the feeling of resignation that lead to people dismissing the possibility of improvement, stating "it is what it is." The challenge in the service of our patients and families, organizations, and communities is to move this dialog forward to "it is what we make it."[13]

When we tell the patient and family they are being discharged it should happen safely, efficiently, predictably, and with empathy. From the perspective of clinicians, it should be as easy as possible to consistently do the right thing and do the work to which they have dedicated themselves. For communities and organizations struggling with access, improving throughput is vital.

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Is Hospital Discharge the Rube Goldberg Machine of Academic Internal Medicine?

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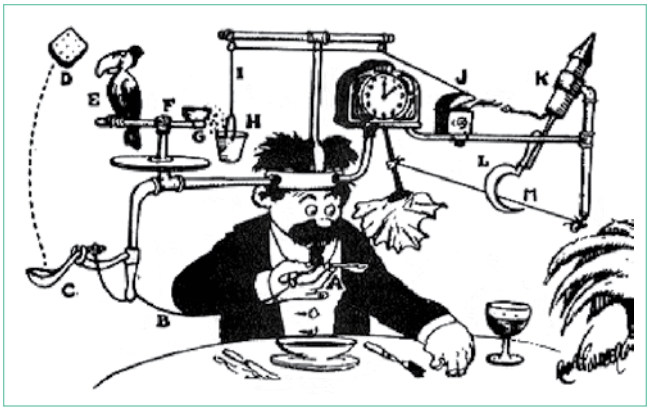
One of the least taught yet most complicated tasks confronting new trainees is the bewildering process of discharging a patient. On an internal medicine service, this process can often resemble a Rube Goldberg machine, in which a "simple" task is accomplished through a series of interconnected, almost comically convoluted, yet separate steps that are triggered one after another and must be executed perfectly in sequence for success. It seems easy at first; just tap out a few sentences in the discharge paperwork, do a quick medication reconciliation, and a click of a button later, voila! The patient magically falls off the list and is on their merry way home. In reality, it only takes one wrench thrown into the Rube Goldberg machine to take down the whole operation. Much to the chagrin of internal medicine interns across the country, residents quickly learn that discharge planning is usually far from straightforward and that a myriad of obstacles (often dynamic and frustratingly unpredictable) can stand in the way of a successful discharge.

While some surgical services can streamline discharge processes to target defined lengths of stay based on a particular diagnosis, general medicine patients tend to have greater numbers of comorbid conditions, complex hospital courses, and wider variation in access to posthospital healthcare. In addition, there is very little formal instruction in transitions of care, and most residents identify direct patient care (learning by doing) as the primary mode of education.[1,2] Struggling through the process of finding an appropriate placement, ensuring adequate outpatient follow-up, and untangling a jumbled mess of a medication reconciliation is often the only way that housestaff learn the Sisyphean task of transitioning care out of the hospital. The unpredictability and intensity of patient care adds to the ever growing list of competing demands on the time and attention of residents. Attendings face pressure on all sides to not only provide exemplary patient care and an educational experience but also to optimize hospital throughput by discharging patients as soon as possible (and ideally before noon). No wonder that the discharge process can threaten to unravel at any time, with delays and complications in discharge metamorphosing into increased length of stay (LOS), poorer outcomes, and increased 30-day readmission rates. As on-the-ground providers, what realities do we face when challenging ourselves to discharge patients before noon, and what practical changes in our workflow can we make to reach this goal?



Professor Butts and the Self-Operating Napkin (1931). Soup spoon (A) is raised to mouth, pulling string (B) and thereby jerking ladle (C), which throws cracker (D) past parrot (E). Parrot jumps after cracker and perch (F) tilts, upsetting seeds (G) into pail (H). Extra weight in pail pulls cord (I), which opens and ignites lighter (J), setting off skyrocket (K), which causes sickle (L) to cut string (M), allowing pendulum with attached napkin to swing back and forth, thereby wiping chin. Rube Goldberg - Originally published in Collier's, September 26 1931.

In this month's *Journal of Hospital Medicine*, Zoucha et al. examine these questions in real time by identifying barriers preventing both "definite" and "possible" discharges at three representative time points over the course of randomly chosen weekdays. They surveyed both housestaff and attendings at five academic hospitals across the United States, and the majority of patients were cared for on teaching services.[3] Reflecting the inherent differences in workflow between teaching and nonteaching services, delays in definite discharges on teaching services were most often hindered by completing rounds and the need to staff the patient with the attending, whereas nonresident services identified other patient-care-related (both urgent and nonurgent) issues to be the culprits. Late-afternoon discharges were delayed on teaching services due to outstanding paperwork and follow-up arrangements, both of which most senior residents are keenly aware of and make their best effort to complete ahead of time. Patients designated as "possible" discharges were awaiting clinical improvement and resolution of disposition issues dependent on social work

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and safe placement, which reasonably seemed independent of service type. These descriptive findings suggest that nonresident services are more efficient than resident teams, and we are keen to identify novel solutions, such as dedicated discharge coordinators,[4] to facilitate the discharge process on resident teams without detracting from the educational value of the rotation.

Zoucha et al. also found that factors beyond our control (having a lower daily census, attending on a nonresident service) were significantly associated with both earlier discharge order entry times and the actual time of patient discharge.[3] While it is tempting to foist the entirety of the blame on extrinsic factors such as discharge placement and insurance issues, the reality is there might be some workflow changes that could expedite the discharge process. The authors are correct to emphasize that rounding style, in which discharges are prioritized to be seen first, is a behavior modification worth targeting. The percentage of teams that routinely see discharges first is not well studied, as other factors, such as clinically unstable patients, new admissions from overnight, and even mundane characteristics such as geographic location in the hospital, can also compete for prioritization in rounding order. Given the authors' findings, we are eager to see further work in this area as prioritization of discharges during rounds could conceivably be studied within the context of a randomized controlled trial. Other innovations in rounding styles such as rounding-in-flow[5] (in which all tasks are completed for a single patient before rounding on the next patient) can also significantly reduce the time to discharge order placement.

With help from the Penn Medicine Center for Health Care Innovation, we are actively studying bottlenecks in the discharge process by developing an interactive platform focused on delivering real-time information to all members of the healthcare team. Rapid rounds are held every morning with the attending physician, floor nursing leadership, physical therapy, social worker, and case management to quickly identify pending tasks, anticipated disposition, and a target date of discharge. Efficiency is key, as each team is limited to approximately 5-10 minutes. Previous studies (mostly pre–post studies) have shown that this simple intervention significantly reduced LOS,[6,7] increased rates of discharge before noon,[8] and was improved by electronic tracking tools.[9] Our multidisciplinary rounds are unique in that information is then entered into an intuitive, web-based platform, which allows consolidation and analysis that permits generation of real-time statistics. By standardizing the discharge planning process, we hope to streamline a previously fragmented process and maximize the efficiency of hospital resource utilization.

Ultimately, high-quality care of complex patients on internal medicine services from admission to discharge requires hard work, smart utilization of resources, and a little bit of luck. There may not be a secret ingredient that guarantees perfectly efficient discharges 100% of the time, but this study inspires us to ponder additional approaches to this longstanding problem. The authors are to be congratulated for a rigorous study that illuminates where we as healthcare providers are able to realistically intervene to expedite the discharge process. First, having a lower census cap may not be possible in this era of maximal hospital usage, but this work suggests that thoughtful management of time on rounds may be a way to address the underlying problem. Secondly, the superior efficiency of nonteaching services may merely reflect the increased experience of the providers, and a realistic solution could be to implement a formal curriculum to educate housestaff about the discharge process, which would simultaneously address residency competency standards for transitions of care. Finally, the role of innovative informatics tools will surely open further avenues of investigation, as we continually evolve in response to intensifying standards of modern, efficient healthcare delivery in the 21st century. It may not be possible to eliminate the complexity from this particular Rube Goldberg machine, but taking the steps above may allow us to implement as many fail-safes as we can.

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We May Not "Have It All," But We Can Make It Better through Structural Changes

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In this issue of the *Journal of Hospital Medicine*, the paper by Gottenborg et al. captures the experiences of female academic hospitalists navigating one of the most significant transitions they will face—becoming new mothers.[1] This article gives an accessible voice to impersonal statistics about the barriers women physicians encounter within and across specialties in academia. The challenges and anecdotes shared by the study participants were eminently relatable and captured the all-too-familiar circumstances most of us with children have faced in our careers as physician mothers.

STUDY COMMENTARY AND DISCUSSION

This study uses qualitative research methods to illustrate the hurdles faced by mothers in hospital medicine beyond what is demonstrated by quantitative measures and provides the helpful step of proposing some solutions to the obstacles they have faced. While the sample size was very small, the women interviewed were diverse in their years in practice, geographic distribution, and percent clinical effort, providing evidence that the themes discussed prevail across demographic categories.

The snowball sampling via the Society of Hospital Medicine committees may not have yielded a representative sample of female hospitalists. It seems possible that women who are involved in this type of leadership may be better supported and/or have different work schedules than their peers who are not in leadership positions. We also wish there had been more emphasis on the systemic and structural factors that can improve the quality of life of physician mothers. These policies include paternity leave and other creative ways of acknowledging the useful skills and experience that motherhood brings to bear on clinical practice, such as increased empathy and compassion, as mentioned by one of the study participants.

Even with the aforementioned limitations, this study is important because it combines authentic quotes from practicing academic hospitalists with concrete and tangible suggestions for structural changes. The most striking element is that the majority of the study participants experienced uncertainty and a lack of transparency around parental leave policies. As nearly half of hospitalists are women and 80% are under age 40,[2] it seems unimaginable that there would not be explicit policies in place for what is a common and largely anticipated life event. Medicine has made great strides toward gender equality, but we are unlikely to ever reach the goal of true parity without openly addressing the disproportionate effect of childbearing and child rearing on women physicians. Standardized, readily available, and equitable parental leave policies (for both birth parents and nonbirth parents) are the first and most critical step.

The absence of standard leave policies naturally puts physician mothers in the position of having to negotiate or "haggle" with various supervisors, the majority of whom are male division chiefs and department chairs,[3] which places all parties in an uncomfortable position, further reinforcing inequities and sowing discord and resentment. Having formal policies around leave protects not only those who utilize parental leave but also the other members of a hospital medicine practice who take on the workload of the person on leave.

Uncertainty around how to address the increased clinical load and for how long, also creates anxiety among other group members and may lead to feelings of bitterness toward clinicians on leave, further contributing to the negative impact of new parenthood on female hospitalists. We can think of no other medical circumstance in which there is as much advance notice of the need for significant time away from work. Yet pregnancy, which is subject to complications and emergencies just like other medical conditions, is treated with so little concern that one may be asked to arrange for their own coverage during such an emergency, as one study subject reported.

We also empathize with the study participants' reports of feeling that supervisors often mentally discounted their ability to participate in projects on return to work. These pernicious assumptions can compound a cycle of lost productivity, disengagement, and attrition from the workforce.

Female hospitalists returning from leave face additional challenges that place an undue burden on their professional activities, most notably related to breastfeeding. This is particularly relevant in the context of the intensity inherent in practicing hospital medicine, which includes long days of being the primary provider for acutely ill inpatients, as well as long stretches of many consecutive days when it may not be possible to return home before children's bedtime. Even at our own institution, which has been recognized as a "Healthy Mothers Workplace," breastfeeding accommodations are not set up to allow for ongoing clinical activities while taking time to express breastmilk,

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and the clinical schedule does not build in adjustments for this time-consuming and psychologically taxing commitment. Breastfeeding for at least one year is the medical recommendation of the American Academy of Pediatrics in line with a substantial body of evidence.[4] One quote from the article poignantly notes, "*Pumping every 3-4 hours: stopping what you're doing, finding an empty room to pump, finding a place to store your milk, then going back to work, three times per shift, for the next 9 months of your life, was hell.*" If we cannot enable our own medical providers to follow evidence-based recommendations, how can we possibly expect this of our patients?

CONCLUSIONS

The notion of women "having it all" is an impossible ideal—both work and life outside of work will inevitably require tradeoffs. However, there is an abundance of evidence and recommendations for concrete steps that can be taken to improve the experience of female physicians who have children. These include formal policies for childbearing and child rearing leave (the American Academy of Pediatrics recommends at least six to nine months[5]), convenient space and protected time for pumping milk during the first year, on-site childcare services and back-up child care, and flexible work schedules.[6] It is time to stop treating childbirth among female physicians like an unexpected inconvenience and acknowledge the undeniable demographics of physicians in hospital medicine and the duty of healthcare systems and hospital medicine leaders to effectively plan for the needs of half of their workforce.

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On Decreasing Utilization: Models of Care for Frequently Hospitalized Patients and Their Effect on Outcomes

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In this month's edition of the *Journal of Hospital Medicine*, Goodwin and colleagues report their findings from their systematic review of models of care for frequently hospitalized patients. The authors reviewed the literature for interventions to reduce hospital admissions in frequently hospitalized patients with the goal of assessing the success of the interventions. This report contributes to the literature base of interventions to reduce healthcare utilization, particularly in the area of inpatient hospitalization.[1]

Goodwin et al. report that only nine studies met their criteria for review after a thorough search of the published literature. Of these nine studies, only four were determined to be high-quality studies. Interestingly, the low-quality studies found positive results in reducing hospital utilization, whereas the high-quality studies found decreases that were mirrored by their control groups. Impressive heterogeneity was found in the range of definitions, interventions, and outcome measures in the studies. These studies highlight the issue of "regression to the mean" for sicker individuals; however, they may not address readmission rates of specific medical systems or procedures that are also cost drivers, even if the patients are not considered critically ill. They also show where research partnerships can assist in increasing the number of members included in the studies for robust analyses.

From the perspective of a health plan, we applaud all efforts to improve patient outcomes and reduce cost. This report states that efforts to reduce chronic hospitalizations have not been unqualified successes. We must reflect upon how reducing utilization and improving outcomes align with our overall goals as a society. Recently, Federal Reserve Chairman Jay Powell summed up our nation's particular issue, stating, "It is widely understood that the United States is on an unsustainable fiscal path, largely due to the interaction between an aging population and a healthcare system that delivers pretty average healthcare at a cost that is much higher than that of any other advanced economy."[2]

A recent Kaiser Family Foundation analysis showed that 1% of patients accounted for 23% of all medical spending in the United States, and 97% of medical spending is attributed to the top 50% of patients.[3] Pharmaceutical costs also play a role in this trend. Blue Cross and Blue Shield of Texas (BCBSTX) found that 2.5% of our population accounted for just under 50% of total medical spending. Conversely, when looking at patients with very high costs, only 0.4% had over $100,000 in spending exclusive of pharmacy. When including pharmacy, that number rises to 0.5%. As we consider annual medical and pharmacy trends year over year, we find that pharmacy spending may outpace hospital expenses in the near future.

Our internal data are also consistent with published reports that fewer than half of high-cost patients in one year continue to be high-cost cases the following year. Niall Brennan et al. reported that only 39% of the top 5% of spenders in a given year are also high spenders the following year.[4] This finding not only coincides with the author's statement around regression to the mean for the high admission utilizers, but it may be instructive to those looking to a Pareto method of attacking cost. If more than half of targeted patients will move out of the high cost category on their own, then demonstrating the effectiveness of interventions becomes challenging. Moreover, this regression finding speaks to the need to create effective programs to manage population health on a broad basis, which can address quality to all members and streamline costs for a large group that covers well more than 50% of medical spending.

BCBSTX emphasizes the creation of systems that let providers become responsible and accountable to outcomes and cost. Accountable Care Organizations (ACOs) and Intensive Medical Homes (IMHs) have played important roles in this journey, but physicians need to continue to invent and prioritize interventions that may achieve both goals. In particular, hospitalists have an important role to play. As ACOs flourish, hospitalists will need to join under the value-based umbrella and continue to intervene in patient care, policies, and procedures to reduce avoidable hospitalizations.

The development of value-based arrangements offers the healthcare system a unique opportunity to bring much-needed change. In our medical partnerships, direct communication with providers regarding their member experience and sharing of vital information about their patients' health status have helped improve patient outcomes and decrease cost. Our IMH partnerships show a savings of up to $45,000 per member per year driven by decreases in admissions and ER visits, and in some cases, expensive medications. The hard work in these successes lies within the subtleties of fostering the relationship between payers and providers. Each pillar within the ecosystem plays a key role offering strengths, but the upside toward

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change comes in how we support each other's weaknesses. This support is manifested in two ways: collaboration through communication and transparency through data sharing.

The road to change is one less traveled but not unpaved; advances in technology allow us to take experiences and build from them. At its core, technology has enhanced our collaboration and data capabilities. The ability to stay in touch with providers allows for almost real-time addressing of issues, promoting efficiency. The connection we have with providers has evolved from being solely paper contracts to a multichannel, multifunctional system. The ability to take claims experience, insert clinical acumen, and perform data analysis brings actionable solutions to be executed by our providers.

Those in the healthcare system will need to come together to continue to create interventions that improve quality while decreasing costs. The second part may require even more work than the first. The Health Care Cost Institute recently published data showing that inpatient utilization over a five-year period fell 12.9% in the commercially insured.[5] However, over that same period, hospital prices for inpatient care rose 24.3%. The fundamental reason for the excess amount of money spent in United States healthcare is that the prices are incredibly high.[6] Currently, when diligence is exercised in reducing utilization, hospitals simply raise prices as a response to compensate for the lost income. Likewise, although prescription drug utilization only increased 1.8% during that period, the prices increased by 24.9%.

For the US healthcare system to improve its quality and reduce its cost, we will need inventive partnerships to continue to create new systems to interact with patients in the most efficient and effective way possible. Readmissions and hospital utilization will be a large part of that improvement. Hospitals and hospitalists should ensure that they continue to focus on making healthcare more affordable by improving efficiency and outcomes and by resisting the tendencies of hospitals and pharmaceutical companies to raise prices in reaction to the improved efficiency.

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Towards Scalable Hospital-Based Palliative Care: Challenges and Opportunities for Hospitalists

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There is growing evidence that supports the ability of specialty palliative care to achieve the Triple Aim in healthcare: (1) improve patient and family experience of care, (2) improve health outcomes, and (3) reduce healthcare costs.[1,2] However, the full realization of this value remains elusive due, in large part, to the increasing demand for specialty palliative care services outpacing the supply of specialists.[3] Because expansion of the specialty palliative care workforce will never be sufficient to meet the needs of seriously ill patients, and nonspecialist physicians often fail to recognize palliative care needs in a timely manner,[4] innovative and systematic solutions are needed to provide high-quality palliative care in a manner that is sustainable.[5]

To close the gap between workforce and patient needs, experts have largely advocated for two care delivery models that aim to improve the organization and allocation of limited palliative care resources: (1) a tier-based approach in which primary palliative care (basic skills for all clinicians) and specialty palliative care (advanced skills requiring additional training) have distinct but supportive roles, and (2) a need-based approach where different types of palliative care clinicians are deployed based on specific needs.[5,6] In this issue, Abedini and Chopra propose a "Palliative Care Redistribution Integrated System Model" (PRISM) that combines these two approaches, with need-based care delivery that escalates through skill tiers to improve hospital-based palliative care.[7]

PRISM is attractive because it leverages the skill sets of clinicians across disciplines and is designed for the hospital, where the vast majority of specialty palliative care is provided in the United States. Moreover, it employs hospitalists who routinely care for a high volume of seriously ill patients, and are therefore well positioned to expand the palliative care workforce. The authors suggest several approaches to implement PRISM, such as designating certain hospitalist teams for palliative care, more interdisciplinary support, automated patient risk stratification or mandatory screening checklists, and strategic use of bedside nurses and social workers to facilitate early basic needs assessments. Although sound in principle, there are several foreseeable barriers to each of these approaches and potential unintended consequences of PRISM in the fields of hospital and palliative medicine.

Applying insights from behavioral economics will be essential for the successful implementation and dissemination of PRISM. Changing clinician behavior is not a challenge unique to palliative care interventions, but it may be particularly difficult due to misperceptions that palliative care is synonymous with end-of-life care and that such conversations are always time-intensive. Indeed, Abedini and Chopra acknowledge that all clinicians need to be well versed in basic palliative care skills for PRISM to succeed, yet most educational initiatives have shown modest results at best. The most promising clinician education programs, such as the Serious Illness Care Program and VitalTalk require intensive training simulations and are most effective when implemented on a system level to promote cultural change.[8,9] Thus, training hospitalists in preparation for PRISM will require considerable upfront investment by hospitals. While policy efforts to improve palliative care training in medical education are progressing (Palliative Care and Hospice Education and Training Act, H.R.1676), any evidence of impact is nearly a generation away.

The authors also advocate for a technology-driven solution for systematic and early identification of palliative care needs. However, ideal clinical decision support would not rely on checklists to be completed by bedside clinicians or "hard stop" alerts in the electronic health record, as both of these approaches rely heavily upon consistent and accurate data entry by busy clinicians. Rather, innovative predictive analytics with machine learning and natural language processing methods hold great promise to support an electronic precision medicine approach for palliative care delivery. Even after such prediction models are developed, rigorous studies are needed to understand how they can change clinician behavior and impact the quality and cost of care.

Shifting palliative care tasks to nonspecialists has implications beyond quality and access. First, there are likely to be reimbursement implications as nonbillable clinicians such as social workers provide palliative care services that were previously provided by physicians and advance practice providers. As value-based payment models grow, healthcare systems may be wise to invest in innovative palliative care delivery models such as PRISM, but obtaining financial support will require rigorous evidence of value. Second, it will be important to monitor the already high rates of burnout

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and emotional exhaustion among palliative care clinicians[10] when implementing care delivery models that select only the most complex patients for referral to specialty palliative care. Finally, new palliative care delivery models must fit within a larger national strategy to grow palliative care across the care continuum.[11] This is of particular importance with hospital-focused solutions such as PRISM due to concerns about the growing split in care coordination between inpatient and outpatient care. Since seriously ill patients spend the majority of time outside the hospital and evidence for the value of palliative care is most robust in home and ambulatory settings,[1] an important role for hospitalists could be to systematically identify and refer high-risk patients to community-based palliative care services after discharge from a sentinel hospitalization.

In conclusion, innovative palliative care delivery models such as PRISM are critical to ensuring that seriously ill patients have access to high-quality palliative care; however, more work is still needed to create the training programs, patient identification tools, scalable implementation, and evaluation processes necessary for success.

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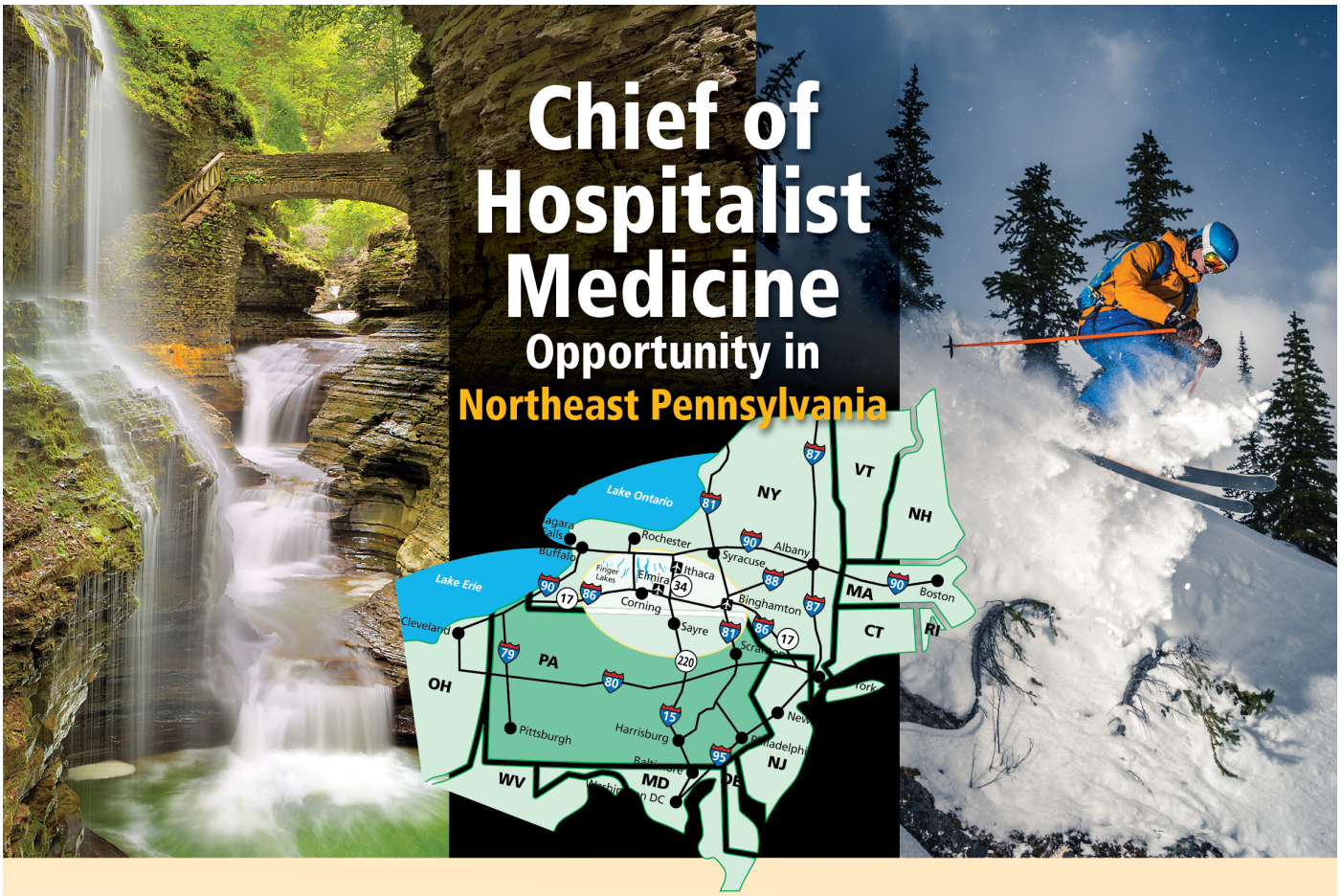

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