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TABLE OF CONTENTS

Volume 13 | Number 6 | June 2018

ORIGINAL RESEARCH

BRIEF REPORTS

RESEARCH LETTERS

REVIEWS

Continued >

CLINICAL CARE CONUNDRUM

EDITORIALS

LETTERS TO THE EDITOR

What Is Career Success for Academic Hospitalists? A Qualitative Analysis of Early-Career Faculty Perspectives

Ethan Cumbler, MD, FHM, FACP[1]*, Essey Yirdaw, MPH[1], Patrick Kneeland, MD[1], Read Pierce, MD[1], Patrick Rendon, MD[2], Carrie Herzke, MD, SFHM, FAAP, FACP[3], Christine D. Jones, MD[1]

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BACKGROUND: Understanding the concept of career success is critical for hospital medicine groups seeking to create sustainably rewarding faculty positions. Conceptual models of career success describe both extrinsic (compensation and advancement) and intrinsic (career satisfaction and job satisfaction) domains. How hospitalists define career success for themselves is not well understood. In this study, we qualitatively explore perspectives on how early-career clinician-educators define career success.

METHODS: We developed a semistructured interview tool of open-ended questions validated by using cognitive interviewing. Transcribed interviews were conducted with 17 early-career academic hospitalists from 3 medical centers to thematic saturation. A mixed deductive-inductive, qualitative, analytic approach was used to code and map themes to the theoretical framework.

RESULTS: The single most dominant theme participants described was "excitement about daily work," which mapped to the job satisfaction organizing theme. Participants frequently expressed the importance of "being respected and recognized" and "dissemination of work," which were within the career satisfaction organizing theme. The extrinsic organizing themes of advancement and compensation were described as less important contributors to an individual's sense of career success. Ambivalence toward the "academic value of clinical work," "scholarship," and especially "promotion" represented unexpected themes.

CONCLUSIONS: The future of academic hospital medicine is predicated upon faculty finding career success. Clinician-educator hospitalists view some traditional markers of career advancement as relevant to success. However, early-career faculty question the importance of some traditional external markers to their personal definitions of success. This work suggests that the self-concept of career success is complex and may not be captured by traditional academic metrics and milestones. *Journal of Hospital Medicine* 2018;13:372-377. Published online first January 19, 2018.

Academic hospital medicine is a young specialty, with most faculty at the rank of instructor or assistant professor.[1] Traditional markers of academic success for clinical and translational investigators emphasize progressive, externally funded grants, achievements in basic science research, and prolific publication in the peer-reviewed literature.[2] Promotion is often used as a proxy measure for academic success.

Conceptual models of career success derived from non-healthcare industries and for physician-scientists include both extrinsic and intrinsic domains.[3,4] Extrinsic domains of career success include financial rewards (compensation) and progression in hierarchical status (advancement).[3,4] Intrinsic domains of career success include pleasure derived from daily work (job satisfaction) and satisfaction derived from aspects of the career over time (career satisfaction).[3,4]

Research is limited regarding hospitalist faculty beliefs about career success. A better understanding of hospitalist perspectives can inform program development to support junior faculty in academic hospital medicine. In this phenomenological, qualitative study, we explore the global concept of career success as perceived by early-career clinician-educator hospitalists.

METHODS

Study Design, Setting, and Participants

We conducted interviews with hospitalists from 3 academic medical centers between May 2016 and October 2016. Purposeful sampling was used.[5] Leaders within each hospital medicine group identified early-career faculty with approximately 2 to 5 years in academic medicine with a rank of instructor or assistant professor at each institution likely to self-identify as clinician-educators for targeted solicitation to enroll. Additional subjects

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were recruited until thematic saturation had been achieved on the personal definition of career success. Participants received disclosure and consent documents prior to enrollment. No compensation was provided to participants. This study was approved by the Colorado Multiple Institutional Review Board.

Interview Guide Development and Content

The semistructured interview format was developed and validated through an iterative process. Proposed questions were developed by study investigators on the basis of review of the literature on career success in nonhealthcare industries and academic hospitalist promotion. The questions were assessed for content validity through a review of interview domains by an academic hospitalist program director (R.P.). Cognitive interviewing with 3 representative academic hospitalists who were not part of the study cohort was done as an additional face-validation step of the question probe structure. As a result of the cognitive interviews, 1 question was eliminated, and a framework for clarifications and answer probes was derived prior to the enrollment of the first study subject. No changes were made to the interview format during the study period.

Data Collection

The principal investigator (E.C.) performed all interviews by using the interview tool consisting of 7 demographic questions and 11 open-ended questions and exploring aspects of the concept of career success. The initial open-ended question, "How would you personally define career success as an academic hospitalist at this stage in your career?" represented the primary question of interest. Follow-up questions were used to better understand responses to the primary question. All interviews were audio recorded, deidentified, and transcribed by the principal investigator. Transcripts were randomly audited by a second investigator (E.Y.) for accuracy and completeness.

Sample Size Determination

Interviews were continued to thematic saturation. After the first 3 interviews were transcribed, 2 members of the research team (E.C. and P.K.) reviewed the transcripts and developed a preliminary thematic codebook for the primary question. Subsequent interviews were reviewed and analyzed against these themes. Interviews were continued to thematic saturation, which was defined as more than 3 sequential interviews with no new identified themes.[6]

Data Analysis

By using qualitative data analysis software (ATLAS.ti version 7; ATLAS.ti Scientific Software Development GmbH, Berlin, Germany), transcriptions were analyzed with a team-based, mixed inductive-deductive approach. An inductive approach was utilized to allow basic theme codes to emerge from the raw text, and thus remaining open to unanticipated themes. Investigators assessed each distinct quote for new themes, confirmatory themes, and challenges to previously developed concepts. Basic themes were then discussed among research team members to determine prominent themes, with basic theme codes added, removed, or combined at this stage of the analysis. Responses to each follow-up question were subsequently assessed for new themes, confirmatory themes, or challenges to previously developed concepts related to the personal definition of career success. A deductive approach was then used to map our inductively generated themes back to the organizing themes of the existing conceptual framework.

RESULTS

We interviewed hospitalists from the University of Colorado (n = 8), University of New Mexico (n = 6), and Johns Hopkins University (n = 3). Subjects primarily identified as clinician-educators. Ninety-four percent (16 of 17) were at the rank of assistant professor, and subjects had been academic hospitalists an average of 3.1 years. Forty-seven percent (8 of 17) were female, and 12% identified as underrepresented minorities. Interviews averaged 32 minutes.

Thematic Mapping to Organizing Themes of the Conceptual Model (Table)

The single most dominant theme, "excitement about daily work" was connected to an intrinsic sense of job satisfaction. Career satisfaction emerged from interviews more frequently than extrinsic organizing themes, such as advancement or compensation. Advancement through promotion was infrequently referenced as part of success, and tenure was never raised despite being available for clinician-educators at 2 of the 3 institutions. Compensation was not referenced in any interviewee's initial definition of career success, although in 1 interview, it came up in response to a follow-up question. The Figure visually represents the relative weighting (shown by the sizes of the boxes) of organizing themes to the early-career hospitalists' self-concepts of career success. Relationships among organizing themes as they emerged from interviews are represented by arrows.

Intrinsic – Job Satisfaction

With regard to job satisfaction, early-career faculty often invoked words such as "excitement," "enjoyment," and "passionate" to describe an overall theme of "excitement about daily work." A positive affective state created by the nature of daily work was described as integral to the personal sense of career success. It was also strongly associated with perception of sustainability in a hospitalist career.

"I think [career success] would be job satisfaction. …So, for me, that would be happiness with my job. I like coming to work. I like doing what I do and at the end of the day going home and saying that was a good day. I like to think that would be success at work…is how I would define it."

This theme was also related to a negative aspect often referred to as burnout, which many identified as antithetical to career success. More often, they described success as a heightened state of enthusiasm for the daily work experience.

"I am staying engaged and excited. So, I am not just taking care of patients; I am not just teaching. Having enough excitement from my work to come home and talk about it at dinner.

TABLE. **Themes and Quotes from Hospitalist Interviews**

Organizing Theme	Basic Theme	Representative Quote
Job satisfaction	Excitement about daily work	"Coming in to work every day and [getting] excited about seeing all of the patients, excited about the clinical care, being excited about teaching my team…that would be successful."
	Practices high-quality, high-value care	"I think developing clinical expertise, both through experience and studying, getting to the point where you can take really excellent care of your patient through expertise would be a sense of success that a lot of academic hospitalists would strive for."
	Clinical proficiency	"Success for me will [be] both becoming completely comfortable and conversant in my clinical responsibilities."
	Ambivalence about the value placed on clinical work	"I remember when I was first starting out in academics and I had a colleague tell me that success in academics is making money while seeing less patients…and I thought to myself, 'Well the whole reason I went to medical school was to learn how to take care of and see patients.'"
Career satisfaction	Respected and recognized	"I would say recognition from my students as a great teacher and recognition of my patients as a great provider. I would say those would be the 2 main components I would associate with academic success."
	Dissemination of individuals' work	"Identifying that you have presented a certain number of workshops or completed a certain number of publications that are allowing one to progress in [his or her] career."
	Developing expertise, a niche	"Starting to find a sphere outside of clinical medicine where I am starting to become an expert in something that is related to hospital medicine." "I do think that to be successful in academics in general you need to have something about which you can make yourself an expert or about which you can create content that's novel."
	Work-life balance, integration	"I would also define success as finding a balance between work and personal life. I think someone who is very well rounded would be considered successful in my eyes."
	Making a difference, quality improvement	"I would feel more personally successful if I had a few projects where I was making a real difference in patient care and the system in which I work."
	Excellence in teaching	"From the educator standpoint, being able to spend more time, or some time, with the residents and maybe being recognized by residents as somebody who is good at teaching them and that they enjoy working with." "So, to me, success is [feeling] like seeing the lightbulb go on for the learner as you describe why you are doing what you are doing for a patient."
	Excellence in multiple professional domains	"I think for me, it is essentially excelling within all of the various different aspects and then hopefully together that meets a role of success."
	Diversity of activities	"For me, success in medicine is being able to find that right balance between clinical and nonclinical and still making sure that I am enjoying what I am doing in both of those arenas given the time that I have."
	Excellence in leadership	"For me, what is really important is when I attain that level of leadership that I also still practice, to some degree, the fundamentals within whatever genre that I am leading. …I genuinely believe a leader should not only be in touch with the frontlines but should know what the frontlines are doing."
	Creating innovative programs	"I've started a program within the residency that was a novel new program. So, I got to…start a program."
	Relationships	"I guess more personally it means…cultivating relationships with colleagues who would empower you to move your career forward."
	Autonomy	"Satisfaction…I think it means I am able to pursue these things in the manner that I want to pursue them."
	Achieving personal best	"Success in general is defined as a person doing all that they can within their own power, knowing that they did everything that they could to succeed. The outcome is not the definition of success."
	Project completion	"I would feel some sense of success with finishing some quality-improvement and research projects."
	Progressive improvement	"I also realize how great it is to continue to gain new skills and feel like you're developing in that way."
	Absence of burnout	"Having enough variety in what I am doing to feel that I am not getting burned out."
	Ambivalence about finding success	"I don't feel much sense of success, either historically or… there is not much that I consider would make me feel successful in the future."

Continued on page 375

To enjoy my days off but at the same time being excited to get back to work."

This description of passion toward the work of being a hospitalist was often linked to a sense of deeper purpose found through the delivery of clinical care and education of learners.

"I really feel that we have the opportunity to very meaningfully and powerfully impact people's lives, and that to me is meaningful. …That's value. ...That's coming home at the end of the day and thinking that you have had a positive impact."

The interviews reflected that core to meaningful work was a

TABLE. **Themes and Quotes from Hospitalist Interviews (continued)**

Organizing Theme	Basic Theme	Representative Quote
Advancement	Promotion (and ambivalence about academic promotion)	"People who have successfully gone up for promotion, I look at that definitely as a marker of success." "I think a lot of people would consider promotion to be a sense of success, although I am not sure it is really as prevalent as it seems that it would be."
	Publications, scholarship (and ambivalence about publications, scholarship)	"Thinking about the things the promotions committee…I guess we need to publish, be involved in various different committees, or show scholarship…" "For me personally, I have less of an emphasis on research and some of the more…scholarly practice of medicine, doing research and the writing of papers and things like that. Although I certainly view some of that as part of career success, for me, success is more about finding an activity that's rewarding and meaningful and that I would want to devote my life to doing."
	Independent research funding	"Part of my definition of career success would be being able to secure that funding then being productive in the research that I am able to do with that time."
	Professional progression	"Meeting the milestones…that are probably defined at the beginning of one's career and then revisited…being able to identify that you have actually met those discrete milestones."
	Protected nonclinical time	"Earning some protected time to work a little bit less on clinical duties."
	Obtaining a leadership role	"I think it would require me to basically have a leadership role."
Compensation	Income-matching needs	"Having the ability to not worry about money would be success for my career. Obviously, not running around buying Christian Louboutin shoes or whatever but…being comfortable in my life."

NOTE: The compensation theme was not spontaneously elicited from the primary question, but it was identified in 1 interview during follow-up questions.

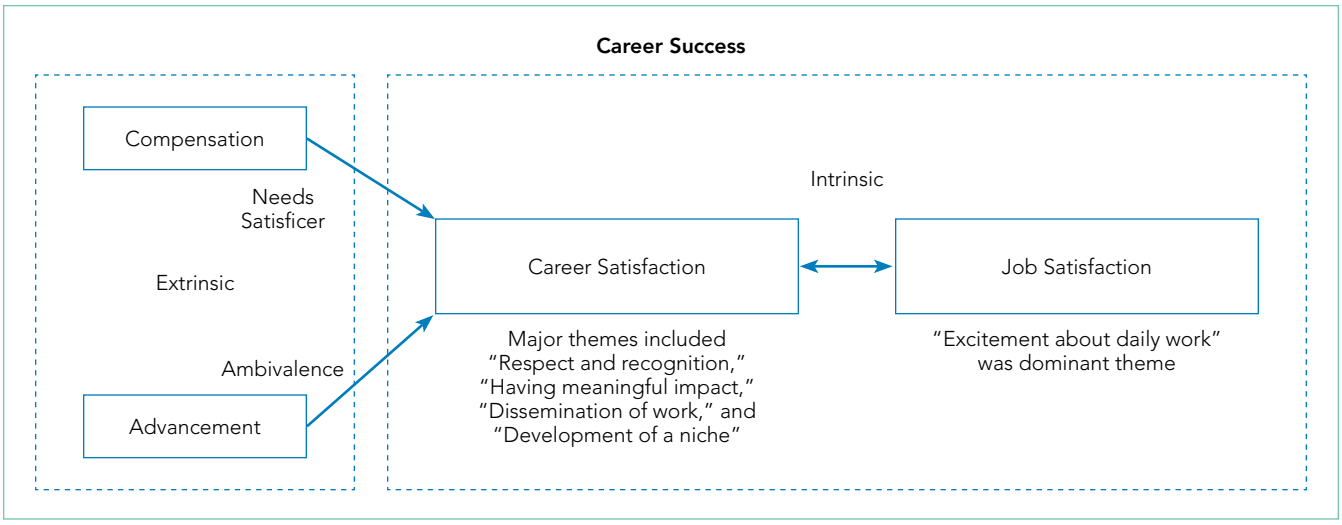

FIG. Organizing Themes

sense of personal efficacy as a clinician, which was reflected in the themes of clinical proficiency and practicing high-quality care.

"I think developing clinical expertise, both through experience and studying. Getting to the point to where you can take really excellent care of your patient through expertise would be a sense of success that a lot of academic hospitalists would strive for."

Intrinsic – Career Satisfaction

Within career satisfaction, participants described that "being respected and recognized" and "dissemination of work" were important contributors to career success. Reputation was frequently referenced as a measure of career success. Reputation was defined by some in a local context of having the respect of learners, peers, and others as a national renown. As a prerequisite for developing a reputation beyond the local academic environment, dissemination of work was often referenced as an important component of satisfaction in the career. This dissemination extended beyond peer-reviewed publications and included other forms of scholarship, presentations at conferences, and sharing clinical innovations between hospitals.

"For me personally, I have less of an emphasis on research and some of the more, I don't want to say 'academic' because I think education is academic, but maybe some of the more scholarly practice of medicine, doing research and the writing of papers and things like that, although I certainly view some of that as a part of career success."

Within career satisfaction, participants also described a diverse set of themes, including progressive improvement in skills, developing a self-perception of excellence in 1 or more arenas of academic medicine, leadership, work–life integration, innovation, and relationships. The concept of developing a niche, or becoming an expert in a particular domain of hospital medicine, was frequently referenced.

"I think part of [success] is 'Have they identified a niche?' Because I think if you want to be in an academic center, as much as I value teaching and taking care of patients, I think one of the advantages is the opportunity to potentially identify an area of expertise."

Participants frequently alluded to the idea that the most important aspects of career satisfaction are not static phenomena but rather values that could evolve over the course of a career. For instance, in the early-career, making a difference with individual learners or patients could have greater valence, but as the career progressed, finding a niche, disseminating work, and building a national reputation would gain importance to a personal sense of career satisfaction.

Extrinsic – Advancement

Promotion was typically referenced when discussing career success, but it was not uniformly valued by early career hospitalists. Some expressed significant ambivalence about its effect on their personal sense of career success. Academic hospitalists identified a number of organizations with definitions of success that influence them. Definitions of success for the university were more relevant to interviewees compared to those of the hospital or professional societies. Interviewees were able to describe a variety of criteria by which their universities define or recognize career success. These commonly included promotion, publications and/or scholarship, and research. The list of factors perceived as success by the hospital were often distinct from those of the university and included cost-effective care, patient safety, and clinical leadership roles.

Participants described a sense of internal conflict when external-stakeholder definitions of success diverged from internal motivators. This was particularly true when this divergence led academic hospitalists to engage in activities for advancement that they did not find personally fulfilling. Academic hospitalists recognized that advancement was central to the concept of career success for organizations even if this was not identified as being core to their personal definitions of success.

"I think that for me, the idea of being promoted and being a leader in the field is less important to me than...for the organization."

Hospitalists expressed that objective markers, such as promotion and publications, were perceived as more important at higher levels of the academic organization, whereas more subjective aspects of success, aligned with intrinsic personal definitions, were more valued within the hospital medicine group.

Extrinsic – Compensation

Compensation was notable for its absence in participants' discussion of career success. When asked about their definitions of career success, academic hospitalists did not spontaneously raise the topic of compensation. The only mention of compensation was in response to a question about how personal and external definitions of career success differ.

Unexpected Findings

While it was almost universally recognized by participants as important, ambivalence toward the "academic value of clinical work," "scholarship," and especially "promotion" represented an unexpected thematic family.

"I can't quite get excited about a title attached to my name or the number of times my name pops up when I enter it into PubMed. My personal definition is more…where do I have something that I am interested [in] that someone else values. And that value is not shown as an associate professorship or an assistant professorship next to my name. …When you push me on it, you could call me clinical instructor forever, and I don't think I would care too much."

The interaction between work and personal activities as representing complementary aspects of a global sense of success was also unexpected and ran contrary to a simplistic conception of work and life in conflict. Academic hospitalists referenced that the ability to participate in aspects of life external to the workplace was important to their sense of career success. Participants frequently used phrases such as "work–life balance" to encompass a larger sense that work and nonwork life needed to merge to form a holistic sense of having a positive impact.

"Personal success is becoming what I have termed a 'man of worth.' I think [that is] someone who feels as though they make a positive impact in the world. Through both my career, but I guess the things that I do that are external to my career. Those would be defined by being a good husband, a good son, a philanthropist out in the community…sometimes, these are not things that can necessarily go on a [curriculum vitae]."

Conflict Among Organizing Themes

At times, academic hospitalists described a tension between day-to-day job satisfaction and what would be necessary to accomplish longer-term career success in the other organizing themes. This was reflected by a sense of trade-off. For instance, activities that lead to some aspects of career satisfaction or advancement would take time away from the direct exposure to learners and clinical care that currently drive job satisfaction.

"If the institution wanted me to be more productive from a research standpoint or…advocate that I receive funding so I could buy down clinical time and interactions I have with my students and my patients, then I can see my satisfaction going down."

Many described a sense of engaging in activities they did not find personally fulfilling because of a sense of expectation that those activities were considered successful by others. Some described a state in which the drive toward advancement as an extrinsic incentive could come at the expense of the intrinsic rewards of being an academic hospitalist.

DISCUSSION

Career success has been defined as "the positive psychological or work-related outcomes or achievements one accumulates as a result of work experiences."[4,7,8] Academic career success for hospitalist faculty isn't as well defined and has not been examined from the perspectives of early-career clinician-educator hospitalist faculty themselves.

The themes that emerged in this study describe a definition of success anchored in the daily work of striving to become an exceptional clinician and teacher. The major themes included (1) having excitement about daily work, (2) having meaningful impact, (3) development of a niche (4) a sense of respect within the sphere of academic medicine, and (5) disseminating work.

Success was very much internally defined as having a positive, meaningful impact on patients, learners, and the systems in which they practice. The faculty had a conception of what promotion committees value and often internalized aspects of this, such as developing a national reputation and giving talks at national meetings. Participants typically self-identified as clinician-educators, and yet dissemination of work remained an important component of personal success. While promotion was clearly identified as a marker of success, academic hospitalists often rejected the supposition of promotion itself as a professional goal. They expressed hope, and some skepticism, that external recognition of career success would follow the pursuit of internally meaningful goals.

While promotion and peer-reviewed publications represent easily measured markers often used as proxies for individual career and programmatic success, our research demonstrates that there is a deep well of externally imperceptible influences on an individual's sense of success as an academic hospitalist. In our analysis, intrinsic elements of career success received far greater weight with early-career academic hospitalists. Our findings are supported by a prior survey of academic physicians that similarly found that faculty with ≥50% of their time devoted to clinical care placed greater career value in patient care, relationships with patients, and recognition by patients and residents compared to national reputation.[9] Similar to our own findings, highly clinical faculty in that study were also less likely to value promotion and tenure as indicators of career success.[9]

The main focus of our questions was how early-career faculty define success at this point in their careers. When asked to extrapolate to a future state of career success, the concept of progression was repeatedly raised. This included successive promotions to higher academic ranks, increasing responsibility, titles, leadership, and achieving competitive roles or awards. It also included a progressively increasing impact of scholarship, growing national reputation, and becoming part of a network of accomplished academic hospitalists across the country. Looking forward, our early-career hospitalists felt that long-term career success would represent accomplishing these things and still being able to be focused on being excellent clinicians to patients, having a work–life balance, and keeping joy and excitement in daily activities.

Our work has limitations, including a focus on early-career clinician-educator hospitalists. The perception of career success may evolve over time, and future work to examine perceptions in more advanced academic hospitalists would be of interest. Our work used purposeful sampling to capture individuals who were likely to self-identify as academic clinician-educators, and results may not generalize to hospitalist physician-scientists or hospitalists in community practices.

Our analysis suggests that external organizations influence internal perceptions of career success. However, success is ultimately defined by the individual and not the institution. Efforts to measure and improve academic hospitalists' attainment of career success should attend to intrinsic aspects of satisfaction in addition to objective measures, such as publications and promotion. This may provide a mechanism to address burnout and improve retention. As important as commonality in themes is the variation in self-definitions of career success among individuals. This suggests the value of inquiry by academic leadership in exploring and understanding what success is from the individual faculty perspective. This may enhance the alignment among personal definitions, organizational values, and, ultimately, sustainable, successful careers.

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A Prescription for Note Bloat: An Effective Progress Note Template

Daniel Kahn, MD[1]*, Elizabeth Stewart, MD[2], Mark Duncan, MD[1], Edward Lee, MD[1], Wendy Simon, MD[1], Clement Lee, MD[1], Jodi Friedman, MD[1], Hilary Mosher, MD[3], Katherine Harris, MD[3], John Bell, MD, MPH[4], Bradley Sharpe, MD[5], Neveen El-Farra, MD[1]

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BACKGROUND: United States hospitals have widely adopted electronic health records (EHRs). Despite the potential for EHRs to increase efficiency, there is concern that documentation quality has suffered.

OBJECTIVE: To examine the impact of an educational session bundled with a progress note template on note quality, length, and timeliness.

DESIGN: A multicenter, nonrandomized prospective trial.

SETTING: Four academic hospitals across the United States.

PARTICIPANTS: Intern physicians on inpatient internal medicine rotations at participating hospitals.

INTERVENTION: A task force delivered a lecture on current issues with documentation and suggested that interns use a newly designed best practice progress note template when writing daily progress notes.

MEASUREMENTS: Note quality was rated using a tool designed by the task force comprising a general impression score, the validated Physician Documentation Quality Instrument, 9-item version (PDQI-9), and a competency questionnaire. Reviewers documented number of lines per note and time signed.

RESULTS: Two hundred preintervention and 199 postintervention notes were collected. Seventy percent of postintervention notes used the template. Significant improvements were seen in the general impression score, all domains of the PDQI-9, and multiple competency items, including documentation of only relevant data, discussion of a discharge plan, and being concise while adequately complete. Notes had approximately 25% fewer lines and were signed on average 1.3 hours earlier in the day.

CONCLUSIONS: The bundled intervention for progress notes significantly improved the quality, decreased the length, and resulted in earlier note completion across 4 academic medical centers. *Journal of Hospital Medicine* 2018;13:378-382. Published online first January 19, 2018.

The widespread adoption of electronic health records (EHRs) has led to significant progress in the modernization of healthcare delivery. Ease of access has improved clinical efficiency, and digital data have allowed for point-of-care decision support tools ranging from predicting the 30-day risk of readmission to providing up-to-date guidelines for the care of various diseases.[1,2] Documentation tools such as copy-forward and autopopulation increase the speed of documentation, and typed notes improve legibility and ease of note transmission.[3,4]

However, all of these benefits come with a potential for harm, particularly with respect to accurate and concise documentation. Many experts have described the perpetuation of false information leading to errors, copying-forward of inconsistent and outdated information, and the phenomenon of "note bloat" – physician notes that contain multiple pages of nonessential information, often leaving key aspects buried or lost.[5-7] Providers seem to recognize the hazards of copy-and-paste functionality yet persist in utilizing it. In 1 survey, more than 70% of attendings and residents felt that copy and paste led to inaccurate and outdated information, yet 80% stated they would still use it.[8]

There is little evidence to guide institutions on ways to improve EHR documentation practices. Recent studies have shown that operative note templates improved documentation and decreased the number of missing components.[9,10] In the nonoperative setting, 1 small pilot study of pediatric interns demonstrated that a bundled intervention composed of a note template and classroom teaching resulted in improvement in overall note quality and a decrease in "note clutter."[11] In a larger study of pediatric residents, a standardized and simplified note template resulted in a shorter note, although notes were completed later in the day.[12] The present study seeks to build upon these efforts by investigating the effect of didactic teaching and an electronic progress note template on note quality, length, and timeliness across 4 academic internal medicine residency programs.

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METHODS

Study Design

This prospective quality improvement study took place across 4 academic institutions: University of California Los Angeles (UCLA), University of California San Francisco (UCSF), University of California San Diego (UCSD), and University of Iowa, all of which use Epic EHR (Epic Corp., Madison, WI). The intervention combined brief educational conferences directed at housestaff and attendings with the implementation of an electronic progress note template. Guided by resident input, a note-writing task force at UCSF and UCLA developed a set of best practice guidelines and an aligned note template for progress notes (supplementary Appendix 1). UCSD and the University of Iowa adopted them at their respective institutions. The template's design minimized autopopulation while encouraging providers to enter relevant data via free text fields (eg, physical exam), prompts (eg, "I have reviewed all the labs from today. Pertinent labs include…"), and drop-down menus (eg, deep vein thrombosis [DVT] prophylaxis: enoxaparin, heparin subcutaneously, etc; supplementary Appendix 2). Additionally, an inpatient checklist was included at the end of the note to serve as a reminder for key inpatient concerns and quality measures, such as Foley catheter days, discharge planning, and code status. Lectures that focused on issues with documentation in the EHR, the best practice guidelines, and a review of the note template with instructions on how to access it were presented to the housestaff. Each institution tailored the lecture to suit their culture. Housestaff were encouraged but not required to use the note template.

Selection and Grading of Progress Notes

Progress notes were eligible for the study if they were written by an intern on an internal medicine teaching service, from a patient with a hospitalization length of at least 3 days with a progress note selected from hospital day 2 or 3, and written while the patient was on the general medicine wards. The preintervention notes were authored from September 2013 to December 2013 and the postintervention notes from April 2014 to June 2014. One note was selected per patient and no more than 3 notes were selected per intern. Each institution selected the first 50 notes chronologically that met these criteria for both the preintervention and the postintervention periods, for a total of 400 notes. The note-grading tool consisted of the following 3 sections to analyze note quality: (1) a general impression of the note (eg, below average, average, above average); (2) the validated Physician Documentation Quality Instrument, 9-item version (PDQI-9) that evaluates notes on 9 domains (up to date, accurate, thorough, useful, organized, comprehensible, succinct, synthesized, internally consistent) on a Likert scale from 1 (not at all) to 5 (extremely); and (3) a note competency questionnaire based on the Accreditation Council for Graduate Medical Education competency note checklist that asked yes or no questions about best practice elements (eg, is there a relevant and focused physical exam).[12]

Graders were internal medicine teaching faculty involved in the study and were assigned to review notes from their respective sites by directly utilizing the EHR. Although this introduces potential for bias, it was felt that many of the grading elements required the grader to know details of the patient that would not be captured if the note was removed from the context of the EHR. Additionally, graders documented note length (number of lines of text), the time signed by the housestaff, and whether the template was used. Three different graders independently evaluated each note and submitted ratings by using Research Electronic Data Capture.[13]

Statistical Analysis

Means for each item on the grading tool were computed across raters for each progress note. These were summarized by institution as well as by pre- and postintervention. Cumulative logit mixed effects models were used to compare item responses between study conditions. The number of lines per note before and after the note template intervention was compared by using a mixed effects negative binomial regression model. The timestamp on each note, representing the time of day the note was signed, was compared pre- and postintervention by using a linear mixed effects model. All models included random note and rater effects, and fixed institution and intervention period effects, as well as their interaction. Inter-rater reliability of the grading tool was assessed by calculating the intraclass correlation coefficient (ICC) using the estimated variance components. Data obtained from the PDQI-9 portion were analyzed by individual components as well as by sum score combining each component. The sum score was used to generate odds ratios to assess the likelihood that postintervention notes that used the template compared to those that did not would increase PDQI-9 sum scores. Both cumulative and site-specific data were analyzed. *P* values < .05 were considered statistically significant. All analyses were performed using SAS version 9.4 (SAS Institute Inc, Cary, NC).

RESULTS

A total of 200 preintervention and 199 postintervention notes were graded (1 note was erroneously selected twice, leading to 49 postintervention notes from that institution). Seventy percent of postintervention notes used the best practice note template.

The mean general impression score significantly improved from 2.0 to 2.3 (on a 1-3 scale in which 2 is average) after the intervention ($P < .001$). Additionally, note quality significantly improved across each domain of the PDQI-9 ($P < .001$ for all domains, Table 1). The ICC was 0.245 for the general impression score and 0.143 for the PDQI-9 sum score.

Among the competency questionnaire, the most profound improvement was documentation of only "relevant lab values and studies and removal of older data rather than importing all information" (29% preintervention, 63% postintervention, $P < .001$; Table 2). Additionally, significant improvements were seen in notes being "concise yet adequately complete," and in documenting a "relevant and focused physical exam," an "updated problem list," and "mention of a discharge plan" (Table 2). Copying and pasting a note from another physician did not decrease significantly ($P = .36$).

TABLE 1. **Comparison of PDQI-9 Mean Scores Between Pre- and Postintervention Progress Notes**

Domain	Pre [IQR] n = 200	Post [IQR] n = 199	*P* value
Up-to-date: The note contains the most recent test results and recommendations.	3.8 [3.3-4.0]	4.1 [3.7-4.7]	<.001
Accurate: The note is true. It is free of incorrect information.	3.8 [3.3-4.3]	4.1 [3.7-4.7]	<.001
Thorough: The note is complete and documents all of the issues of importance to the patient.	3.7 [3.3-4.0]	4.0 [3.4-4.6]	<.001
Useful: The note is extremely relevant, providing valuable information and/or analysis.	3.6 [3.2-4.0]	3.9 [3.3-4.3]	<.001
Organized: The note is well formed and structured in a way that helps the reader understand the patient's clinical course.	3.6 [3.3-4.0]	4.0 [3.7-4.4]	<.001
Comprehensible: The note is clear, without ambiguity or sections that are difficult to understand.	3.7 [3.3-4.0]	4.0 [3.7-4.5]	<.001
Succinct: The note is brief, to the point, and without redundancy.	3.4 [3.0-3.7]	3.8 [3.3-4.3]	<.001
Synthesized: The note reflects the author's understanding of the patient's status and ability to provide a plan of care.	3.6 [3.3-4.0]	3.9 [3.3-4.3]	<.001
Internally consistent: No part of the note ignores or contradicts any other part.	3.7 [3.3-4.0]	4.1 [3.7-4.7]	<.001

NOTE: PDQI-9 is a validated note scoring tool. Abbreviations: IQR, interquartile range; PDQI-9, Physician Documentation Quality Instrument, 9-item version; Post, postintervention; Pre, preintervention.

TABLE 2. **Comparison of Percentage of Note Competency Questionnaire "Yes" Responses Between Pre- and Postintervention Progress Notes**

Questionnaire Items	Pre n = 200	Post n = 199	*P* value
Are overnight events mentioned or is there an acknowledgement that there were none?	92%	94%	.36
Are the patient's complaints documented or is there an acknowledgement that there were none?	97%	100%	.41
Is there a relevant and focused physical exam documented?	87%	95%	<.001
Have relevant lab values and studies been documented rather than pasting all the information, and have older studies been removed?	29%	63%	<.001
Have relevant lab values and studies been addressed in the problem-oriented assessment and plan?	79%	88%	<.001
Is there a prioritized and updated problem list?	86%	91%	<.001
Is there a global assessment of whether the patient is clinically the same, improving, or worsening?	35%	46%	.04
Is DVT prophylaxis (or reason why it is not required) documented?	87%	97%	.20
Is code status documented?	90%	94%	.49
Is there mention of a discharge plan, goals of hospitalization, or estimated length of stay?	47%	78%	<.001
Is the author's name listed at the bottom of the note?	99%	99%	.98
Is the note copied and pasted from another physician's note?	14%	5%	.36
Is the note concise yet adequately complete (no excessive copy and paste, no excessive repetition of data, no missing key information, etc)?	61%	81%	<.001

NOTE: Abbreviations: DVT, deep vein thrombosis; Post, postintervention; Pre, Preintervention.

Three of four institutions documented the number of lines per note and the time the note was signed by the intern. Mean number of lines per note decreased by 25% (361 lines preintervention, 265 lines postintervention, $P < .001$). Mean time signed was approximately 1 hour and 15 minutes earlier in the day (3:27 PM preintervention and 2:10 PM postintervention, $P < .001$).

Site-specific data revealed variation between sites. Template use was 92% at UCSF, 90% at UCLA, 79% at Iowa, and 21% at UCSD. The mean general impression score significantly improved at UCSF, UCLA, and UCSD, but not at Iowa. The PDQI-9 score improved across all domains at UCSF and UCLA, 2 domains at UCSD, and 0 domains at Iowa. Documentation of pertinent labs and studies significantly improved at UCSF, UCLA, and Iowa, but not UCSD. Note length decreased at UCSF and UCLA, but not at UCSD. Notes were signed earlier at UCLA and UCSD, but not at UCSF.

When comparing postintervention notes based on template use, notes that used the template were significantly more likely to receive a higher mean impression score (odds ratio [OR] 11.95, $P < .001$), higher PDQI-9 sum score (OR 3.05, $P < .001$), be approximately 25% shorter (326 lines vs 239 lines, $P < .001$), and be completed approximately 1 hour and 20 minutes earlier (3:07 PM vs 1:45 PM, $P < .001$) than nontemplated notes from that same period. Additionally, at each institution, templated notes were more likely than nontemplated notes to receive a higher PDQI-9 sum score (OR at UCSF 6.81, $P < .05$; OR at UCLA 17.95, $P < .001$; OR at UCSD 10.99, $P < .001$; OR at Iowa 4.01, $P < .05$).

DISCUSSION

A bundled intervention consisting of educational lectures and a best practice progress note template significantly improved the quality, decreased the length, and resulted in earlier completion of inpatient progress notes. These findings are consistent with a prior study that demonstrated that a bundled note template intervention improved total note score and reduced note clutter.[11] We saw a broad improvement in progress notes across all 9 domains of the PDQI-9, which corresponded with an improved general impression score. We also found statistically significant improvements in 7 of the 13 categories of the competency questionnaire.

Arguably the greatest impact of the intervention was shortening the documentation of labs and studies. Autopopulation can lead to the appearance of a comprehensive note; however, key data are often lost in a sea of numbers and imaging reports.[6,14] Using simple prompts followed by free text such as, "I have reviewed all the labs from today. Pertinent labs include…" reduced autopopulation and reminded housestaff to identify only the key information that affected patient care for that day, resulting in a more streamlined, clear, and high-yield note.

The time spent documenting care is an important consideration for physician workflow and for uptake of any note intervention.[14-18] One study from 2016 revealed that internal medicine housestaff spend more than half of an average shift using the computer, with 52% of that time spent on documentation.[17] Although functions such as autopopulation and copy-forward were created as efficiency tools, we hypothesize that they may actually prolong note writing time by leading to disorganized, distended notes that are difficult to use the following day. There was concern that limiting these "efficiency functions" might discourage housestaff from using the progress note template. It was encouraging to find that postintervention notes were signed 1.3 hours earlier in the day. This study did not measure the impact of shorter notes and earlier completion time, but in theory, this could allow interns to spend more time in direct patient care and to be at lower risk of duty hour violations.[19] Furthermore, while the clinical impact of this is unknown, it is possible that timely note completion may improve patient care by making notes available earlier for consultants and other members of the care team.

We found that adding an "inpatient checklist" to the progress note template facilitated a review of key inpatient concerns and quality measures. Although we did not specifically compare before-and-after documentation of all of the components of the checklist, there appeared to be improvement in the domains measured. Notably, there was a 31% increase ($P < .001$) in the percentage of notes documenting the "discharge plan, goals of hospitalization, or estimated length of stay." In the surgical literature, studies have demonstrated that incorporating checklists improves patient safety, the delivery of care, and potentially shortens the length of stay.[20-22] Future studies should explore the impact of adding a checklist to the daily progress note, as there may be potential to improve both process and outcome measures.

Institution-specific data provided insightful results. UCSD encountered low template use among their interns; however, they still had evidence of improvement in note quality, though not at the same level of UCLA and UCSF. Some barriers to uptake identified were as follows: (1) interns were accustomed to import labs and studies into their note to use as their rounding report, and (2) the intervention took place late in the year when interns had developed a functional writing system that they were reluctant to change. The University of Iowa did not show significant improvement in their note quality despite a relatively high template uptake. Both of these outcomes raise the possibility that in addition to the template, there were other factors at play. Perhaps because UCSF and UCLA created the best practice guidelines and template, it was a better fit for their culture and they had more institutional buy-in. Or because the educational lectures were similar, but not standardized across institutions, some lectures may have been more effective than others. However, when evaluating the postintervention notes at UCSD and Iowa, templated notes were found to be much more likely to score higher on the PDQI-9 than nontemplated notes, which serves as evidence of the efficacy of the note template.

Some of the strengths of this study include the relatively large sample size spanning 4 institutions and the use of 3 different assessment tools for grading progress note quality (general impression score, PDQI-9, and competency note questionnaire). An additional strength is our unique finding suggesting that note writing may be more efficient by removing, rather than adding, "efficiency functions." There were several limitations of this study. Pre- and postintervention notes were examined at different points in the same academic year, thus certain domains may have improved as interns progressed in clinical skill and comfort with documentation, independent of our intervention.[21] However, our analysis of postintervention notes across the same time period revealed that use of the template was strongly associated with higher quality, shorter notes and earlier completion time arguing that the effect seen was not merely intern experience. The poor interrater reliability is also a limitation. Although the PDQI-9 was previously validated, future use of the grading tool may require more rater training for calibration or more objective wording.[23] The study was not blinded, and thus, bias may have falsely elevated postintervention scores; however, we attempted to minimize bias by incor-

porating a more objective yes/no competency questionnaire and by having each note scored by 3 graders. Other studies have attempted to address this form of bias by printing out notes and blinding the graders. This design, however, isolates the note from all other data in the medical record, making it difficult to assess domains such as accuracy and completeness. Our inclusion of objective outcomes such as note length and time of note completion help to mitigate some of the bias.

Future research can expand on the results of this study by introducing similar progress note interventions at other institutions and/or in nonacademic environments to validate the results and expand generalizability. Longer term follow-up would be useful to determine if these effects are transient or long lasting. Similarly, it would be interesting to determine if such results are sustained even after new interns start suggesting that institutional culture can be changed. Investigators could focus on similar projects to improve other notes that are particularly at a high risk for propagating false information, such as the History and Physical or Discharge Summary. Future research should also focus on outcomes data, including whether a more efficient note can allow housestaff to spend more time with patients, decrease patient length of stay, reduce clinical errors, and improve educational time for trainees. Lastly, we should determine if interventions such as this can mitigate the widespread frustrations with electronic documentation that are associated with physician and provider burnout.[15,24] One would hope that the technology could be harnessed to improve provider productivity and be effectively integrated into comprehensive patient care.

Our research makes progress toward recommendations made by the American College of Physicians "to improve accuracy of information recorded and the value of information," and develop automated tools that "enhance documentation quality without facilitating improper behaviors."[19] Institutions should consider developing internal best practices for clinical documentation and building structured note templates.[19] Our research would suggest that, combined with a small educational intervention, such templates can make progress notes more accurate and succinct, make note writing more efficient, and be harnessed to improve quality metrics.

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Interhospital Transfer and Receipt of Specialty Procedures

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The practice of transferring patients between acute care hospitals is variable and largely nonstandardized. Although often-cited reasons for transfer include providing patients access to specialty services only available at the receiving institution, little is known about whether and when patients receive such specialty care during the transfer continuum. We performed a retrospective analysis using 2013 100% Master Beneficiary Summary and Inpatient claims files from Centers for Medicare and Medicaid Services. Beneficiaries were included if they were aged ≥65 years, continuously enrolled in Medicare A and B, with an acute care hospitalization claim, and transferred to another acute care hospital with a primary diagnosis of acute myocardial infarction, gastrointestinal bleed, renal failure, or hip fracture/dislocation. Associated specialty procedure codes (*International Classification of Diseases*, 9th Revision, Clinical Modification) were identified for each diagnosis. We performed descriptive analyses to compare receipt of specialty procedural services between transferring and receiving hospitals, stratified by diagnosis. Across the 19,613 included beneficiaries, receipt of associated specialty procedures was more common at the receiving than the transferring hospital, with the exception of patients with a diagnosis of gastrointestinal bleed. Depending on primary diagnosis, between 32.4% and 89.1% of patients did not receive any associated specialty procedure at the receiving hospital. Our results demonstrate variable receipt of specialty procedural care across the transfer continuum, implying the likelihood of alternate drivers of interhospital transfer other than solely receipt of specialty procedural care. *Journal of Hospital Medicine* 2018;13:383-387. Published online first November 8, 2017. © 2018 Society of Hospital Medicine

Patients who undergo interhospital transfer (IHT) are felt to benefit from receipt of unique specialty care at the receiving hospital.[1] Although only 1.5% of all hospitalized Medicare patients undergo hospital transfer,[2] the frequency of transfer is much greater within certain patient populations, as may be expected with diagnoses requiring specialty care.[3,4] Existent data demonstrate that 5% of Medicare patients admitted to the intensive care unit (ICU)[5] and up to 50% of patients presenting with acute myocardial infarction (AMI) undergo IHT.[6]

More recent data suggest variability in hospital transfer practices not accounted for by differences in patient or hospital characteristics.[2] Although disease-specific guidelines for IHT exist for certain diagnoses,[3,4] the process remains largely nonstandardized for many patients,[7] leading to ambiguity surrounding indications for transfer. Because limited data suggest worse outcomes for transferred versus nontransferred patients,[8] a better understanding of the specialized care patients actually receive across the transfer continuum may help to elucidate potential indications for transfer and ultimately help delineate which patients are most (or least) likely to benefit from transfer and why.

In this national study, we examined a select cohort of transferred patients with diagnoses associated with specific specialty procedural services to determine if they received these procedures and where along the transfer continuum they were performed.

METHODS

We performed a cross-sectional analysis using the Center for Medicare and Medicaid Services 2013 100% Master Beneficiary Summary and Inpatient claims files. Our study protocol was approved by the Partners Healthcare Human Subjects Review Committee.

Beneficiaries were eligible for inclusion if they were aged ≥65 years, continuously enrolled in Medicare A and B, and with an acute care hospitalization claim in 2013, excluding Medicare managed care and end stage renal disease beneficiaries due to incomplete claims data in these groups. We additionally excluded beneficiaries hospitalized at federal or nonacute care hospitals, or critical access hospitals given their mission to stabilize and then transfer patients to referral hospitals.[9]

Transferred patients were defined as beneficiaries with corresponding "transfer in" and "transfer out" claims, or those with either claim and a corresponding date of admission/discharge from another hospital within 1 day of the claim, as

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we used in our prior research.[2] Beneficiaries transferred to the same hospital, those with greater than 1 transfer within the same hospitalization, or those cared for at hospitals with "outlier" transfer-in rates equal to 100% or transfer-out rates greater than 35% were excluded from analysis given the suggestion of nonstandard claims practices.

We first identified the top 15 primary diagnoses at time of transfer using International Classification of Diseases, Ninth Revision (ICD-9) codes (supplementary Appendix), and then identified those 4 most likely to require specialty procedural services: AMI, gastrointestinal bleed (GI bleed), renal failure, and hip fracture/dislocation. We then chose associated ICD-9 procedure codes for each diagnosis, via expert opinion (authors SM and JS, hospitalist physicians with greater than 20 years of combined clinical experience), erring on overinclusion of procedure codes. We then quantified receipt of associated procedures at transferring and receiving hospitals, stratified by diagnosis.

We further explored the cohort of patients with hip fracture/dislocation who underwent an associated procedure at the transferring but not receiving hospital, examining the frequency with which these patients had other (nonrelated) procedures at the receiving hospital, and identifying which procedures they received.

RESULTS

Of the 101,507 patients transferred to another hospital, 19,613 (19.3%) had a primary diagnosis of AMI, GI bleed, renal failure, or hip fracture/dislocation. Table 1 lists the ICD-9 procedure codes associated with each diagnosis.

Distribution of receipt of specialty procedures at the transferring and receiving hospitals varied by disease (Figure). With the exception of GI bleed, patients more often received specialty procedural care at the receiving than the transferring hospital. Depending on primary diagnosis, between 32.4% and 89.1% of patients did not receive any associated specialty procedure at the receiving hospital.

Of the 370 (22.1%) hip fracture/dislocation patients that received a specialty procedure at the transferring but not receiving hospital, 132 (35.7%) did not receive any procedure at the receiving hospital, whereas the remaining 238 (64.3%) received an unrelated (not associated with the primary diagnosis) procedure. There was great variety in the types of procedures received, the most common being transfusion of blood products (ICD-9 Clinical Modification 9904).

DISCUSSION

Among transferred patients with primary diagnoses that have clearly associated specialized procedural services, we found that patients received these procedures at varying frequency and locations across the transfer continuum. Across 4 diagnoses, receipt of associated procedures was more common at the receiving than the transferring hospital, with the exception being patients with GI bleed. We additionally found that many transferred patients did not receive any associated specialty procedure at the receiving hospital. These findings suggest the strong likelihood of more diverse underlying reasons for transfer rather than solely receipt of specialized procedural care.

Despite the frequency with which AMI patients are transferred,[6] and American Heart Association guidelines directing hospitals to transfer AMI patients to institutions able to provide necessary invasive treatments,[4] prior studies suggest these patients inconsistently receive specialty intervention following transfer, including stress testing, cardiac catheterization, or coronary artery bypass graft surgery.[10,11] Our findings add to these data, demonstrating that only 47.3% of patients transferred with AMI received any cardiac-related procedure at the receiving hospital. Additionally, we found that 38.1% of AMI patients do not receive any specialty procedures at either the transferring or the receiving hospital. Taken together, these data suggest possible discrepancies in the perceived need for these procedures between transferring and receiving hospitals, reasons for transfer related to these conditions that don't involve an associated procedure, or reasons for transfer unrelated to specialty care of the primary diagnosis (such as care of comorbidities, hospital location, prior relationships with that hospital, or desire for a second opinion). Although some of these alternate reasons for transfer likely still benefit the patient, some of these reasons may not justify the increased risks of discontinuity of care created by IHT.

Given limited data looking at IHT practices for patients with other diagnoses, the varying patterns of specialty procedural interventions we observed among transferred patients with GI bleed, renal failure, and hip fracture/dislocation are novel contributions to this topic. Notably, we found that among patients transferred with a primary diagnosis of renal failure, the vast majority (84.1%) did not receive any associated procedure at either the transferring or the receiving hospital. It is possible that although these patients carried the diagnosis of renal failure, their clinical phenotype is more heterogeneous, and they could still be managed conservatively without receipt of invasive procedures such as hemodialysis.

Conversely, patients transferred with primary diagnosis of hip fracture/dislocation were far more likely to receive associated specialty procedural intervention at the receiving hospital, presumably reflective of the evidence demonstrating improved outcomes with early surgical intervention.[12] However, these data do not explain the reasoning behind the substantial minority of patients who received specialty intervention at the transferring hospital prior to transfer or those that did not receive any specialty intervention at either the transferring or receiving hospital. Our secondary analysis demonstrating great variety in receipt and type of nonassociated procedures provided at the receiving hospital did not help to elucidate potential underlying reasons for transfer.

Notably, among patients transferred with primary diagnosis of GI bleed, receipt of specialty procedures was more common at the transferring (77.7%) than receiving (63.2%) hospital, with nearly half (49.3%) undergoing specialty procedures at both hospitals. It is possible that these findings are reflective of the broad array of specialty procedures examined within this diag-

TABLE. **Associated Specialty Procedures for Diagnoses of Transferred Patients**

Primary Diagnosis	Transferred Patients[a] (N = 19,613), n (%)	Associated ICD-9 Procedure Code	Description	Associated Procedures at Transferring Hospital[b], n (%)	Associated Procedures at Receiving Hospital[b], n (%)
Acute myocardial infarction	12,780 (65.2)	CM 36	Operations on vessels of heart	56 (0.4)	2868 (22.4)
		CM 37	Other operations on heart and pericardium	3480 (27.2)	2846 (22.3)
		CM 39.6	Extracorporeal circulation and procedures auxiliary to heart surgery	2 (0.02)	27 (0.2)
		CM 88.4	Arteriography using contrast material	19 (0.1)	9 (0.07)
		CM 88.5	Angiocardiography using contrast material	189 (1.5)	227 (1.8)
		CM 89.4	Cardiac stress tests, pacemaker and defibrillator checks	35 (0.3)	20 (0.2)
		CM 89.5	Other nonoperative cardiac and vascular diagnostic procedures	89 (0.7)	7 (0.05)
		CM 92	Nuclear medicine	8 (0.06)	2 (0.02)
		CM 99.6	Conversion of cardiac rhythm	56 (0.4)	40 (0.3)
Gastrointestinal bleed	3014 (15.4)	CM 39.98	Control of hemorrhage, not otherwise specified	3 (0.1)	8 (0.3)
		CM 39.1	Intra-abdominal venous shunt (TIPS)	0 (0)	11 (0.4)
		CM 42	Operations on esophagus	32 (1.1)	48 (1.6)
		CM 43	Incision and excision of stomach	15 (0.5)	54 (1.8)
		CM 44	Other operations on stomach (including endoscopy)	237 (7.9)	289 (9.6)
		CM 45	Incision, excision, and anastomosis of intestine (including colonoscopy)	1074 (35.6)	1183 (39.3)
		CM 46	Other operations on intestine	1 (0.03)	11 (0.4)
		CM 48	Operations on rectum, rectosigmoid, and perirectal tissue	13 (0.4)	22 (0.7)
		CM 49	Operations on anus	4 (0.1)	7 (0.2)
		CM 54	Other operations on abdominal region	6 (0.2)	28 (0.9)
		CM 88.4	Arteriography using contrast material	17 (0.6)	38 (1.3)
		CM 89.5	Other nonoperative cardiac and vascular diagnostic procedures	7 (0.2)	1 (0.03)
		CM 92	Nuclear medicine	4 (0.1)	3 (0.1)
		CM 96.3	Nonoperative alimentary tract irrigation, cleaning, and local instillation	1 (0.03)	0 (0)
		CM 99.0	Transfusion of blood and blood components	928 (30.8)	200 (6.6)
Renal failure	2148 (11.0)	CM 39.95	Hemodialysis	39 (1.8)	80 (3.7)
		CM 54.95	Peritoneal dialysis	0 (0)	0 (0)
		CM 55	Operations on kidney (including biopsy)	29 (1.4)	96 (4.5)
		CM 56	Operations on ureter	3 (0.1)	9 (0.4)
		CM 57	Operations on urinary bladder	57 (2.7)	39 (1.8)
		CM 58	Operations on urethra	4 (0.2)	3 (0.1)
		CM 87.71-87.79	X-ray of urinary system	8 (0.4)	8 (0.4)
Hip fracture/dislocation	1671 (8.5)	CM 78	Other operations on bones, except facial bones	29 (1.7)	72 (4.3)
		CM 79	Reduction of fracture and dislocation	218 (13.0)	555 (33.2)
		CM 80	Incision and excision of joint structures	0 (0)	1 (0.06)
		CM 81	Repair and plastic operations on joint structures	149 (8.9)	501 (30.0)

[a]Of the 101,507 transferred patients, 19,613 (19.3%) had a primary diagnosis of acute myocardial infarction, gastrointestinal bleed, renal failure, or hip fracture/dislocation.
[b]Indicates the number of patients receiving each procedure at transferring and receiving hospitals.

NOTE: Abbreviations: CM, Clinical Modification; ICD-9, International Classification of Diseases, Ninth Revision; TIPS, Transjugular Intrahepatic Portosystemic Shunt.

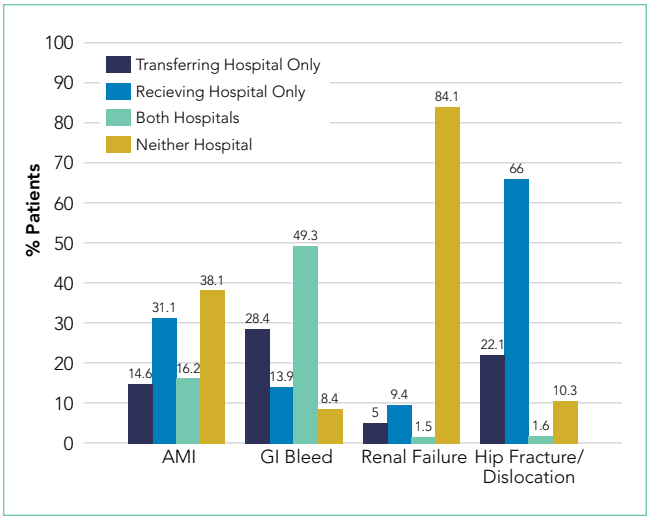

FIG. Frequency of disease-specific procedures at transferring and receiving hospitals.

NOTE: Abbreviations: AMI, acute myocardial infarction; GI, gastrointestinal.

nosis. For example, it is reasonable to consider that a patient may be stabilized with receipt of a blood transfusion at the transferring hospital, then transferred to undergo a diagnostic/therapeutic procedure (ie, endoscopy/colonoscopy) at the receiving hospital, as is suggested by our results.

Our study is subject to several limitations. First, given the criteria we used to define transfer, it is possible that we included nontransferred patients within our transferred cohort if they were discharged from one hospital and admitted to a different hospital within 1 day, although quality assurance analyses we conducted in prior studies on these data support the validity of the criteria used.[2] Second, we cannot exclude the possibility that patients received nonprocedural specialty care (ie, expert opinion, specialized imaging, medical management, management of secondary diagnoses, etc.) not available at the transferring hospital, although, arguably, in select patients, such input could be obtained without physical transfer of the patient (ie, tele-consult). And even in patients transferred with intent to receive procedural care who did not ultimately receive that care, there is likely an appropriate "nonprocedure" rate, where patients who might benefit from a procedure receive a timely evaluation to reduce the risk of missing the opportunity to receive it. This would be analogous to transferring a patient to an ICU even if they do not end up requiring intubation or pressor therapy. However, given the likelihood of higher risks of IHT compared with intrahospital transfers, one could argue that the threshold of perceived benefit might be different in patients being considered for IHT. Additionally, we limited our analyses to only 4 diagnoses; thus, our findings may not be generalizable to other diagnoses of transferred patients. However, because the diagnoses we examined were ones considered most effectively treated with specialty procedural interventions, it is reasonable to presume that the variability in receipt of specialty procedures observed within these diagnoses is also present, if not greater, across other diagnoses. Third, although we intentionally included a broad array of specialty procedures associated with each diagnosis, it is possible that we overlooked particular specialty interventions. For example, in assuming that patients are most likely to be transferred to receive procedural services associated with their primary diagnosis, we may have missed alternate indications for transfer, including need for procedural care related to secondary or subsequent diagnoses (ie, a patient may have presented with GI bleed in the context of profound anemia that requires a bone marrow biopsy for diagnosis, and thus was transferred for the biopsy). Our further examination of unrelated procedures received by hip fracture/dislocation patients at receiving hospitals argues against a select or subset of procedures driving transfers that are not associated with the primary diagnosis but does not fully rule out this possibility (ie, if there are a large variety of secondary diagnoses with distinct associated specialty procedures that are required for each). Lastly, although our examination provides novel information regarding variability in receipt of specialty procedures of transferred patients, we were not able to identify exact reasons for transfer. Instead, our results are hypothesis generating and require further investigation to better understand these reasons.

CONCLUSIONS

We found that Medicare patients who undergo IHT with primary diagnoses of AMI, GI bleed, renal failure, and hip fracture/dislocation receive associated specialty interventions at varying frequency and locations, and many patients do not receive any associated procedures at receiving hospitals. Our findings suggest that specialty procedural care of patients, even those with primary diagnoses that often warrant specialized intervention, may not be the primary driver of IHT as commonly suggested, although underlying reasons for transfer in these and other "nonprocedural" transferred patients remains obscure. Given known ambiguity in the transfer process,[7] and unclear benefit of IHT,[8] additional research is required to further identify and evaluate other potential underlying reasons for transfer and to examine these in the context of patient outcomes, in order to understand which patients may or may not benefit from transfer and why.

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Hospitalist and Internal Medicine Leaders' Perspectives of Early Discharge Challenges at Academic Medical Centers

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Improving early discharges may improve patient flow and increase hospital capacity. We conducted a national survey of academic medical centers addressing the prevalence, importance, and effectiveness of early-discharge initiatives. We assembled a list of hospitalist and general internal medicine leaders at 115 US-based academic medical centers. We emailed each institutional representative a 30-item online survey regarding early-discharge initiatives. The survey included questions on discharge prioritization, the prevalence and effectiveness of early-discharge initiatives, and barriers to implementation. We received 61 responses from 115 institutions (53% response rate). Forty-seven (77%) "strongly agreed" or "agreed" that early discharge was a priority. "Discharge by noon" was the most cited goal (n = 23; 38%) followed by "no set time but overall goal for improvement" (n = 13; 21%). The majority of respondents reported early discharge as more important than obtaining translators for non-English-speaking patients and equally important as reducing 30-day readmissions and improving patient satisfaction. The most commonly reported factors delaying discharge were availability of postacute care beds (n = 48; 79%) and patient-related transport complications (n = 44; 72%). The most effective early discharge initiatives reported involved changes to the rounding process, such as preemptive identification and early preparation of discharge paperwork (n = 34; 56%) and communication with patients about anticipated discharge (n = 29; 48%). There is a strong interest in increasing early discharges in an effort to improve hospital throughput and patient flow. *Journal of Hospital Medicine* 2018;13:388-391. Published online first December 6, 2017. © 2018 Society of Hospital Medicine

The discharge process is a critical bottleneck for efficient patient flow through the hospital. Delayed discharges translate into delays in admissions and other patient transitions, often leading to excess costs, patient dissatisfaction, and even patient harm.[1-3] The emergency department is particularly impacted by these delays; bottlenecks there lead to overcrowding, increased overall hospital length of stay, and increased risks for bad outcomes during hospitalization.[2]

Academic medical centers in particular may struggle with delayed discharges. In a typical teaching hospital, a team composed of an attending physician and housestaff share responsibility for determining the discharge plan. Additionally, clinical teaching activities may affect the process and quality of discharge.[4-6]

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The prevalence and causes of delayed discharges vary greatly.[7-9] To improve efficiency around discharge, many hospitals have launched initiatives designed to discharge patients earlier in the day, including goal setting ("discharge by noon"), scheduling discharge appointments, and using quality-improvement methods, such as Lean Methodology (LEAN), to remove inefficiencies within discharge processes.[10-12] However, there are few data on the prevalence and effectiveness of different strategies.

The aim of this study was to survey academic hospitalist and general internal medicine physician leaders to elicit their perspectives on the factors contributing to discharge timing and the relative importance and effectiveness of early-discharge initiatives.

METHODS

Study Design, Participants, and Oversight

We obtained a list of 115 university-affiliated hospitals associated with a residency program and, in most cases, a medical school from Vizient Inc. (formerly University HealthSystem Consortium), an alliance of academic medical centers and affiliated hospitals. Each member institution submits clinical data to allow for the benchmarking of outcomes to drive transparency and quality improvement.[13] More than 95% of the nation's academic medical centers and affiliated hospitals participate in this collaborative. Vizient works with members but does not set nor promote quality metrics, such as discharge timeliness.

E-mail addresses for hospital medicine physician leaders (eg, division chief) of major academic medical centers were obtained from each institution via publicly available data (eg, the institution's website). When an institution did not have a hospital medicine section, we identified the division chief of general internal medicine. The University of California, San Francisco Institutional Review Board approved this study.

Survey Development and Domains

We developed a 30-item survey to evaluate 5 main domains of interest: current discharge practices, degree of prioritization of early discharge on the inpatient service, barriers to timely discharge, prevalence and perceived effectiveness of implemented early-discharge initiatives, and barriers to implementation of early-discharge initiatives.

Respondents were first asked to identify their institutions' goals for discharge time. They were then asked to compare the priority of early-discharge initiatives to other departmental quality-improvement initiatives, such as reducing 30-day readmissions, improving interpreter use, and improving patient satisfaction. Next, respondents were asked to estimate the degree to which clinical or patient factors contributed to delays in discharge. Respondents were then asked whether specific early-discharge initiatives, such as changes to rounding practices or communication interventions, were implemented at their institutions and, if so, the perceived effectiveness of these initiatives at meeting discharge targets. We piloted the questions locally with physicians and researchers prior to finalizing the survey.

Data Collection

We sent surveys via an online platform (Research Electronic Data Capture).[14] Nonresponders were sent two e-mail reminders and then a follow-up telephone call asking them to complete the survey. Only 1 survey per academic medical center was collected. Any respondent who completed the survey within 2 weeks of receiving it was entered to win a Kindle Fire.

Data Analysis

We summarized survey responses using descriptive statistics. Analysis was completed in IBM SPSS version 22 (Armonk, NY).

RESULTS

Survey Respondent and Institutional Characteristics

Of the 115 institutions surveyed, we received 61 responses (response rate of 53%), with 39 (64%) respondents from divisions of hospital medicine and 22 (36%) from divisions of general internal medicine. A majority (n = 53; 87%) stated their medicine services have a combination of teaching (with residents) and nonteaching (without residents) teams. Thirty-nine (64%) reported having daily multidisciplinary rounds.

Early Discharge as a Priority

Forty-seven (77%) institutional representatives strongly agreed or agreed that early discharge was a priority, with discharge by noon being the most common target time (n = 23; 38%). Thirty (50%) respondents rated early discharge as more important than improving interpreter use for non-English-speaking patients and equally important as reducing 30-day readmissions (n = 29; 48%) and improving patient satisfaction (n = 27; 44%).

TABLE 1. **Factors Perceived to "Always" or "Often" Cause Discharge Delays at Academic Medical Centers (n = 61)**[a]

Factor	n (%)
Clinical care	
Pending consults, specialist recommendations	27 (44)
Pending clinical care (eg, PICC not placed)	21 (34)
New clinical results changing discharge plan	10 (16)
External factors	
Logistical difficulties (eg, SNF bed unavailable or transport delayed)	48 (79)
Patient factors	
Patient preference to stay	29 (48)
Patient-related transport issues	44 (72)
Workflow	
Busy case managers, competing primary team priorities	38 (62)
Medical education demands of providers (eg, teaching or clinics)	13 (21)

[a] Missing data from participants who did not answer this question are excluded from N.
NOTE: Abbreviations: PICC, peripherally inserted central catheter; SNF, skilled nursing facility.

Factors Delaying Discharge

The most common factors perceived as delaying discharge were considered external to the hospital, such as postacute care bed availability or scheduled (eg, ambulance) transport delays (n = 48; 79%), followed by patient factors such as patient transport issues (n = 44; 72%). Less commonly reported were workflow issues, such as competing primary team priorities or case manager bandwidth (n = 38; 62%; Table 1).

Initiatives to Improve Discharge

The most commonly implemented initiatives perceived as effective at improving discharge times were the preemptive identification of early discharges to plan discharge paperwork (n = 34; 56%), communication with patients about anticipated discharge time on the day prior to discharge (n = 29; 48%), and the implementation of additional rounds between physician teams and case managers specifically around discharge planning (n = 28; 46%). Initiatives not commonly implemented included regular audit of and feedback on discharge times to providers and teams (n = 21; 34%), the use of a discharge readiness checklist (n = 26; 43%), incentives such as bonuses or penalties (n = 37; 61%), the use of a whiteboard to indicate discharge times (n = 23; 38%), and dedicated quality-improvement approaches such as LEAN (n = 37; 61%; Table 2).

DISCUSSION

Our study suggests early discharge for medicine patients is a priority among academic institutions. Hospitalist and gener-

TABLE 2. **Implementation and Perceived Effectiveness of Early Discharge Initiatives at 61 Academic Medical Centers**[a]

Initiative	"Effective" or "Very Effective" n (%)	Not Attempted
Preemptive identification of early discharges to plan discharge paperwork	34 (56)	3 (5)
Communication with patients about their anticipated discharge time on prior day	29 (48)	10 (16)
Additional rounds with teams and/or case managers specifically focused on discharge planning	28 (46)	11 (18)
Prioritizing rounding on patients who can be discharged earlier in the day	24 (39)	5 (8)
Promoting discharge as a divisional priority	22 (36)	4 (7)
Regular audit and feedback discharge times to providers and teams	15 (25)	21 (34)
Use of discharge readiness checklist	13 (21)	26 (43)
Incentives (eg, bonuses or penalties)	12 (20)	37 (61)
Utilizing a whiteboard to indicate discharge time for the patient and family	8 (13)	23 (38)
Dedicated Lean Methodology or other system initiatives	4 (7)	37 (61)

[a]Missing data from participants who did not answer this question are excluded from N.
NOTE: Abbreviation:

al internal medicine physician leaders in our study generally attributed delayed discharges to external factors, particularly unavailability of postacute care facilities and transportation delays. Having issues with finding postacute care placements is consistent with previous findings by Selker et al.[15] and Carey et al.[8] This is despite the 20-year difference between Selker et al.'s study and the current study, reflecting a continued opportunity for improvement, including stronger partnerships with local and regional postacute care facilities to expedite care transition and stronger discharge-planning efforts early in the admission process. Efforts in postacute care placement may be particularly important for Medicaid-insured and uninsured patients.

Our responders, hospitalist and internal medicine physician leaders, did not perceive the additional responsibilities of teaching and supervising trainees to be factors that significantly delayed patient discharge. This is in contrast to previous studies, which attributed delays in discharge to prolonged clinical decision-making related to teaching and supervision.[4-6,8] This discrepancy may be due to the fact that we only surveyed single physician leaders at each institution and not residents. Our finding warrants further investigation to understand the degree to which resident skills may impact discharge planning and processes.

Institutions represented in our study have attempted a variety of initiatives promoting earlier discharge, with varying levels of perceived success. Initiatives perceived to be the most effective by hospital leaders centered on two main areas: (1) changing individual provider practice and (2) anticipatory discharge preparation. Interestingly, this is in discordance with the main factors labeled as causing delays in discharges, such as obtaining postacute care beds, busy case managers, and competing demands on primary teams. We hypothesize this may be because such changes require organization- or system-level changes and are perceived as more arduous than changes at the individual level. In addition, changes to individual provider behavior may be more cost- and time-effective than more systemic initiatives.

Our findings are consistent with the work published by Wertheimer and colleagues,[11] who show that additional afternoon interdisciplinary rounds can help identify patients who may be discharged before noon the next day. In their study, identifying such patients in advance improved the overall early-discharge rate the following day.

Our findings should be interpreted in light of several limitations. Our survey only considers the perspectives of hospitalist and general internal medicine physician leaders at academic medical centers that are part of the Vizient Inc. collaborative. They do not represent all academic or community-based medical centers. Although the perceived effectiveness of some initiatives was high, we did not collect empirical data to support these claims or to determine which initiative had the greatest relative impact on discharge timeliness. Lastly, we did not obtain resident, nursing, or case manager perspectives on discharge practices. Given their roles as frontline providers, we may have missed these alternative perspectives.

Our study shows there is a strong interest in increasing early discharges in an effort to improve hospital throughput and patient flow.

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The Use of Clinical Decision Support in Reducing Diagnosis of and Treatment of Asymptomatic Bacteriuria

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Clinical decision support (CDS) embedded within the electronic health record (EHR) is a potential antibiotic stewardship strategy for hospitalized patients. Reduction in urine testing and treating asymptomatic bacteriuria (ASB) is an important strategy to promote antibiotic stewardship. We created an intervention focused on reducing urine testing for asymptomatic patients at a large tertiary care center. The objective of this study was to design an intervention to reduce unnecessary urinalysis and urine culture (UC) orders as well as the treatment of ASB. We performed a quasiexperimental study among adult inpatients at a single academic institution. We implemented a bundled intervention, including information broadcast in newsletters, hospital-wide screensavers, and passive CDS messages in the EHR. We investigated the impact of this strategy on urinalysis, UC orders, and on the treatment of ASB by using an interrupted time series analysis. Our intervention led to reduced UC order as well as reduced antibiotic orders in response to urinalysis orders and UC results. This easily implementable bundle may play an important role as an antibiotic stewardship strategy. *Journal of Hospital Medicine* 2018;13:392-395. Published online first December 6, 2017. © 2018 Society of Hospital Medicine

INTRODUCTION

Reducing the treatment of asymptomatic bacteriuria (ASB), or isolation of bacteria from a urine specimen in a patient without urinary tract infection (UTI) symptoms, is a key goal of antibiotic stewardship programs.[1] Treatment of ASB has been associated with the emergence of resistant organisms and subsequent UTI risk among women with recurrent UTI.[2,3] The Infectious Diseases Society of America and the American Board of Internal Medicine Foundation's Choosing Wisely campaign recommend against treating ASB, with the exception of pregnant patients and urogenital surgical patients.[1,4]

Obtaining urinalyses and urine cultures (UC) in asymptomatic patients may contribute to the unnecessary treatment of ASB. In a study of hospitalized patients, 62% received urinalysis testing, even though 82% of these patients did not have UTI symptoms.[5] Of the patients found to have ASB, 30% were given antibiotics.[5] Therefore, interventions aimed at reducing urine testing may reduce ASB treatment.

Electronic passive clinical decision support (CDS) alerts and electronic education may be effective interventions to reduce urine testing.[6] While CDS tools are recommended in antibiotic stewardship guidelines,[7] they have led to only modest improvements in appropriate antibiotic prescribing and are typically bundled with time-intensive educational interventions.[8] Furthermore, most in-hospital interventions to decrease ASB treatment have focused on intensive care units (ICUs).[9] We hypothesized that CDS and electronic education would decrease (1) urinalysis and UC ordering and (2) antibiotic orders for urinalyses and UCs in hospitalized adult patients.

METHODS

Population

We conducted a prospective time series analysis (preintervention: September 2014 to June 2015; postintervention: September 2015 to June 2016) at a large tertiary medical center. All hospitalized patients ≥18 years old were eligible except those admitted to services requiring specialized ASB management (eg, leukemia and lymphoma, solid organ transplant, and obstetrics).[1] The study was declared quality improvement by the Johns Hopkins Institutional Review Board.

Intervention

In August 2015, we implemented a multifaceted intervention that included provider education and passive electronic CDS

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TABLE. **Percentage of Visits with Urine Studies Sent, Preintervention and Postintervention, and Change in Slope of Urine Studies per Monthly Admission Before and After the Intervention**

Type of Urine Study	Percentage of Monthly Admissions, Preintervention	Percentage of Monthly Admissions, Postintervention	Absolute Rate Difference per 100 Monthly Admissions	Coefficient for Change in Trend over Time (95% CI) [*P* Value][a]	Slope (Coefficient) of Linear Regression, Preintervention[a]	Slope (Coefficient) of Linear Regression, Postintervention[a]	Estimated Number per 100 Monthly Admissions in January 2016 (with Intervention)[a]	Estimated Number per Total Monthly Admissions in January 2016 (without Intervention)[a]
Total urinalyses	70.5%	60.3%	−10.2%	0.043 (−0.030 to 0.12) [=.24]	−0.016 (0.78)	−0.013 (0.79)	59.7	53.4
Total UC	18.2%	11.8%	−6.3%	−0.030 (−0.041 to 0.019) [<.001]	−0.0031 (0.20)	−0.0052 (0.19)	11.6	14.9
Simultaneous urinalyses and UC	14.9%	9.1%	−5.8%	−0.039 (−0.052 to 0.025) [<.001]	−0.0018 (0.16)	−0.0037 (0.14)	8.9	13.1
UC following urinalyses within 1-24 hours	2.5%	2.1%	−0.66%	−0.0027 (−0.0084 to 0.0030) [=.33]	−0.00038 (0.029)	−0.00055 (0.029)	2.1	2.3
Urinalyses and antibiotics ordered simultaneously	0.9%	0.8%	−0.24%	−0.0032 (−0.0066 to 0.00033) [=.073]	0.00033 (0.0089)	−0.00031 (0.013)	13.9	17.2
Urinalyses followed by antibiotic within 1-24 hours	4.4%	3.9%	−0.56%	−0.0087 (−0.015 to 0.0015) [=.021]	0.00078 (0.041)	−0.00060 (0.048)	3.8	5.3
UC results followed by antibiotic order within 24 hours	1.7%	1.5%	−0.24%	−0.0069 (−0.013 to 0.00051) [=.036]	0.0011 (0.012)	−0.00049 (0.022)	1.4	2.9

[a]Estimate from interrupted time series analysis.

NOTE: Abbreviations: CI, confidence interval; UC, urine culture.

(supplementary Appendix 1 and supplementary Appendix 2). Materials were disseminated through hospital-wide computer workstation screensavers and a 1-page e-mailed newsletter to department of medicine clinicians. The CDS tool included simple informational messages recommending against urine testing without symptoms and against treating ASB; these messages accompanied electronic health record (EHR; Allscripts Sunrise Clinical Manager, Chicago, IL) orders for urinalysis, UC, and antibiotics commonly used within our institution to treat UTI (cefazolin, cephalexin, ceftriaxone, trimethoprim-sulfamethoxazole, nitrofurantoin, and ciprofloxacin). The information was displayed automatically when orders for these tests and antibiotics were selected; provider acknowledgment was not required to proceed.

Data Collection

The services within our hospital are geographically located. We collected orders for urinalysis, UC, and the associated antibiotics for all units except those housing patients excluded from our study. As the CDS tool appeared only in the inpatient EHR, only postadmission orders were included, excluding emergency department orders. For admissions with multiple urinalyses, urinalysis orders placed ≥72 hours apart were eligible. Only antibiotics ordered for ≥24 hours were included, excluding on-call and 1-time antibiotic orders.

Our approach to data collection attempted to model a clinician's decision-making pathway from (1) ordering a urinalysis, to (2) ordering a UC in response to a urinalysis result, to (3) ordering antibiotics in response to a urinalysis or UC result. We focused on order placement rather than results to prioritize avoiding testing in asymptomatic patients, as our institution does not require positive urinalyses for UC testing (reflex testing). Urinalyses resulted within 1 to 2 hours, allowing for clinicians to quickly order UCs after urinalysis result review. Urinalysis and UC orders per monthly admissions were defined as (1) urinalyses, (2) UCs, (3) simultaneous urinalysis and UC (within 1 hour of each other), and (4) UCs ordered 1 to 24 hours after urinalysis. We also analyzed the following antibiotic orders per monthly admissions: (1) simultaneous urinalysis and antibiotic orders, (2) antibiotics ordered 1 to 24 hours after urinalysis order, and (3) antibiotics ordered within 24 hours of the UC result.

Outcome Measures

All outcome measures were calculated as the change over time per total monthly admissions in the preintervention and postintervention periods. In addition to symptoms, urinalysis is a critical, measurable early step in determining the presence

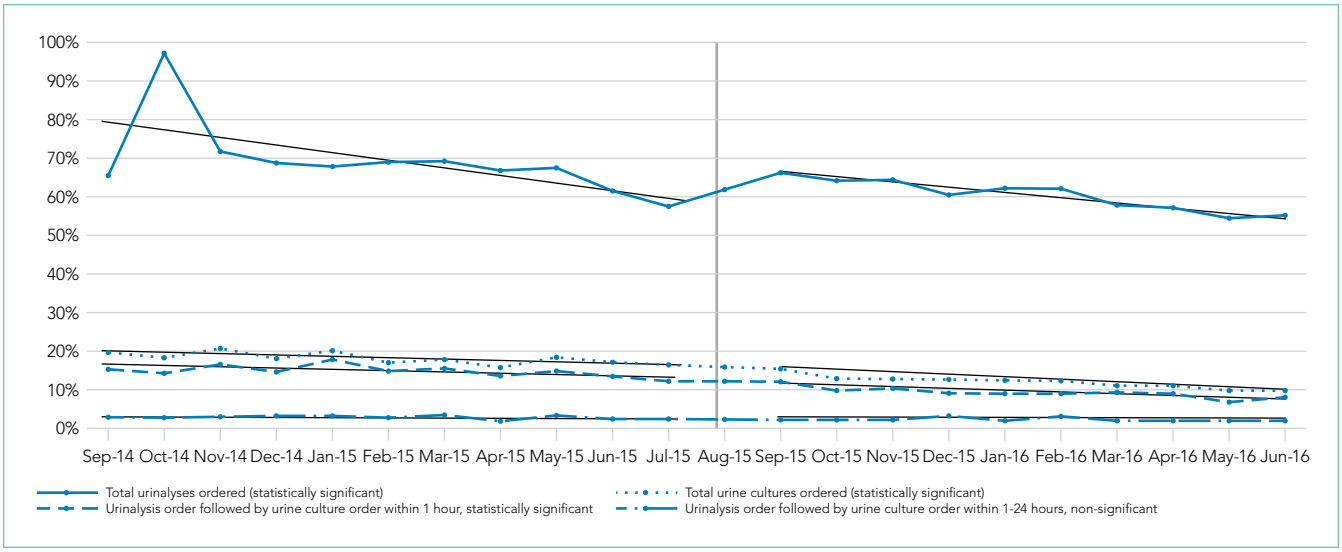

FIG. Proportion of admissions with urinalysis and urine culture orders, preintervention (9/2014-6/2015) and postintervention (9/2015-6/2016).

of ASB. Therefore, the primary outcome measure was the postintervention change in monthly urinalysis orders, and the secondary outcome measure was the postintervention change in monthly UC orders. Additional outcome measures included monthly postintervention changes in (1) UC ordered 1 to 24 hours after urinalyses, (2) urinalyses and antibiotics ordered simultaneously, (3) antibiotic orders within 1 to 24 hours of urinalyses, and (4) antibiotics ordered within 24 hours of UC result.

Statistical Analysis

Statistical analyses were performed by using Stata (version 14.2; StataCorp LLC, College Station, TX). An interrupted time series analysis was performed to compare the change in orders per 100 monthly admissions in preintervention and postintervention periods. To do this, we created 2 separate segmented linear regression models for each dependent variable, pre- and postintervention. Normality was assumed because of large numbers. Rate differences per 100 monthly admissions are also calculated as the total number of orders divided by the total number of admissions in postintervention and preintervention periods with Mantel-Haenszel estimators. Differences were considered statistically significant at $P \leq .05$.

RESULTS

After the intervention, urinalysis orders did not decrease (−10.2%; $P = .24$), but UC orders decreased 6.3% ($P < .001$; Figure; Table). There were fewer simultaneous urinalysis and UC orders after the intervention (−5.8%; $P < .001$). A decrease in UC following urinalyses within 1 to 24 hours did not reach statistical significance (−0.66%; $P = .33$).

There was a decrease in urinalysis orders followed by antibiotic orders within 1 to 24 hours (−0.56%; $P = .021$) and in UC results followed by an antibiotic order within 24 hours (−0.24%; $P = .036$). However, a decrease in urinalyses and antibiotics ordered simultaneously did not reach statistical significance (−0.24%; $P = .073$).

DISCUSSION

A multifaceted but simple bundle of CDS and provider education reduced UC testing but not urinalyses in a large tertiary care hospital. The bundle also reduced antibiotic ordering in response to urinalyses as well as antibiotic ordering in response to UC results.

Other in-hospital CDS tools to decrease ASB treatment have focused only on ICUs.[9,10] Our intervention was evaluated hospital-wide and included urinalyses and UCs. Our intervention was clinician directed and not laboratory directed, such as a positive urinalysis reflexing to a UC. Simultaneous urinalysis and UC testing may lead to ASB treatment, as clinicians treat the positive UC and ignore the negative urinalysis.[11,12] Therefore, we focused on UCs being sent in response to urinalyses.

We chose to focus on laboratory testing data instead of administrative diagnoses for UTI. The sensitivity of administrative data to determine similar conditions such as catheter-associated UTIs is low (0%).[13]

Our single-center study may not be generalizable to other settings. We did not include emergency department patients, as this location used a different EHR. In addition, given the 600,000 yearly hospital admissions, it was impractical to assess the appropriateness of each antibiotic-based documentation of symptoms. Instead of focusing on symptoms of ASB or UTI diagnoses, we focused on ordering urinalysis, UC, and antibiotics. In investigating the antibiotics most frequently used to treat UTI in our hospital, we may have both missed some patients who were treated with other antibiotics for ASB (eg, 4th generation cephalosporins, penicillins, carbapenems, etc) and captured patients receiving antibiotics for indications other than UTI (eg, pneumonia). In our focus on overall ordering practices across a hospital, we did not capture data on bladder catheterization status or the predominant organism seen in UC. At the time of the intervention, the laboratory did not have the resources for urinalysis testing reflexing to UC. However, our intervention did not prevent ordering simultaneous urinal-

ysis and UC in symptomatic patients in general or urosepsis in particular. With only 12 total time points, the interrupted time series analysis may have been underpowered.[14] We also do not know if the intervention's effect would decay over time.

Although the intervention took very little staff time and resources, alert fatigue was a risk.[15] We attempted to mitigate this alert fatigue by making the CDS passive (in the form of a brief informational message) with no provider action required. In conversations with providers in our institution, there has been dissatisfaction with alerts requiring action, as these are thought to be overly intrusive. We are also not clear on which element of the intervention bundle (ie, the CDS or the educational intervention) may have had more of an impact, as the elements of the intervention bundle were rolled out simultaneously. It is possible and even probable that both elements are needed to raise awareness of the problem. Also, as our EHR required all interventions to be rolled out hospital-wide simultaneously, we were unable to randomize certain floors or providers to the CDS portion of the intervention bundle. Other analyses including the type of hospital unit were beyond the scope of this brief report.

Our intervention bundle was associated with reduced UC orders and reduced antibiotics ordered after urinalyses. If a provider does not know there is bacteriuria, then the provider will not be tempted to order antibiotics. This easily implementable bundle may play an important role as an antimicrobial stewardship strategy for ASB.

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Physiologic Monitor Alarm Rates at 5 Children's Hospitals

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Alarm fatigue has been linked to patient morbidity and mortality in hospitals due to delayed or absent responses to monitor alarms. We sought to describe alarm rates at 5 freestanding children's hospitals during a single day and the types of alarms and proportions of patients monitored by using a point-prevalence, cross-sectional study design. We collected audible alarms on all inpatient units and calculated overall alarm rates and rates by alarm type per monitored patient per day. We found a total of 147,213 alarms during the study period, with 3-fold variation in alarm rates across hospitals among similar unit types. Across hospitals, one-quarter of monitored beds were responsible for 71%, 61%, and 63% of alarms in medical-surgical, neonatal intensive care, and pediatric intensive care units, respectively. Future work focused on addressing nonactionable alarms in patients with the highest alarm counts may decrease alarm rates. *Journal of Hospital Medicine* 2018;13:396-398. Published online first April 25, 2018. © 2018 Society of Hospital Medicine

Alarm fatigue is a patient safety hazard in hospitals[1] that occurs when exposure to high rates of alarms leads clinicians to ignore or delay their responses to the alarms.[2,3] To date, most studies of physiologic monitor alarms in hospitalized children have used data from single institutions and often only a few units within each institution.[4] These limited studies have found that alarms in pediatric units are rarely actionable.[2] They have also shown that physiologic monitor alarms occur frequently in children's hospitals and that alarm rates can vary widely within a single institution,[5] but the extent of variation between children's hospitals is unknown. In this study, we aimed to describe and compare physiologic monitor alarm characteristics and the proportion of patients monitored in the inpatient units of 5 children's hospitals.

METHODS

We performed a cross-sectional study using a point-prevalence design of physiologic monitor alarms and monitoring during a 24-hour period at 5 large, freestanding tertiary-care children's hospitals. At the time of the study, each hospital had an alarm management committee in place and was working to address alarm fatigue. Each hospital's institutional review board reviewed and approved the study.

We collected 24 consecutive hours of data from the inpatient units of each hospital between March 24, 2015, and May 1, 2015. Each hospital selected the data collection date within that window based on the availability of staff to perform data collection.[6] We excluded emergency departments, procedural areas, and inpatient psychiatry and rehabilitation units. By using existing central alarm-collection software that interfaced with bedside physiologic monitors, we collected data on audible alarms generated for apnea, arrhythmia, low and high oxygen saturation, heart rate, respiratory rate, blood pressure, and exhaled carbon dioxide. Bedside alarm systems and alarm collection software differed between centers; therefore, alarm types that were not consistently collected at every institution (eg, alarms for electrode and device malfunction, ventilators, intracranial and central venous pressure monitors, and temperatures probes) were excluded. To estimate alarm rates and to account for fluctuations in hospital census throughout the day,[7] we collected census (to calculate the number of alarms per patient day) and the number of monitored patients (to calculate the number of alarms per monitored-patient day, including only monitored patients in the denominator) on each unit at 3 time points, 8 hours apart. Patients were considered continuously monitored if they had presence of a waveform and data for pulse oximetry, respiratory rate, and/or heart rate at the time of data collection. We then determined the rate of alarms by unit type – medical-surgical unit (MSU), neonatal in-

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TABLE 1. **Median Alarm Rate Per Patient Day and Per Monitored-Patient Day and Percentage of Patients Monitored by Hospital and Unit Type**

		Hospital				
		A	B	C	D	E
MSU	Percentage Monitored	32%	48%	38%	40%	26%
	Alarms per patient day	15	20	34	45	40
	Alarms per monitored-patient day	42	50	78	104	155
NICU	Percentage Monitored	100%	97%	100%	100%	100%
	Alarms per patient day	133	135	153	115	351
	Alarms per monitored-patient day	133	140	153	115	351
PICU	Percentage Monitored	100%	100%	100%	100%	100%
	Alarms per patient day	104	54	235	112	310
	Alarms per monitored-patient day	104	54	235	112	310

NOTE: Abbreviations: MSU, medical-surgical unit; NICU, neonatal intensive care unit; PICU, pediatric intensive care unit.

tensive care unit (NICU), or pediatric intensive care unit (PICU) – and the alarm types. Based on prior literature demonstrating up to 95% of alarms contributed by a minority of patients on a single unit,[8] we also calculated the percentage of alarms contributed by beds in the highest quartile of alarms. We also assessed the percentage of patients monitored by unit type. The Supplementary Appendix shows the alarm parameter thresholds in use at the time of the study.

RESULTS

A total of 147,213 eligible clinical alarms occurred during the 24-hour data collection periods in the 5 hospitals. Alarm rates differed across the 5 hospitals, with the highest alarm hospitals having up to 3-fold higher alarm rates than the lowest alarm hospitals (Table 1). Rates also varied by unit type within and across hospitals (Table 1). The highest alarm rates overall during the study occurred in the NICUs, with a range of 115 to 351 alarms per monitored patient per day, followed by the PICUs (range 54-310) and MSUs (range 42-155).

While patient monitoring in the NICUs and PICUs was nearly universal (97%-100%) at institutions during the study period, a range of 26% to 48% of beds were continuously monitored in MSUs. Of the 12 alarm parameters assessed, low oxygen saturation had the highest percentage of total alarms in both the MSUs and NICUs for all hospitals, whereas the alarm parameter with the highest percentage of total alarms in the PICUs varied by hospital. The most common alarm types in 2 of the 5 PICUs were high blood pressure alarms and low pulse oximetry, but otherwise, this varied across the remainder of the units (Table 2).

Averaged across study hospitals, one-quarter of the monitored beds were responsible for 71% of alarms in MSUs, 61% of alarms in NICUs, and 63% of alarms in PICUs.

TABLE 2. **Top 3 Alarm Parameters with the Highest Percentage of Total Alarms by Hospital and Unit**

Hospital	MSU	NICU	PICU
A	SPO2 low (41%)	SPO2 low (61%)	BP high (25%)
	HR low (35%)	SPO2 high (19%)	BP low (21%)
	HR high (21%)	HR low (11%)	SPO2 low (15%)
B	SPO2 low (44%)	SPO2 low (30%)	SPO2 low (31%)
	HR high (16%)	SPO2 high (25%)	RR low (20%)
	RR high (11%)	RR low (15%)	HR high (15%)
C	SPO2 low (36%)	SPO2 low (45%)	BP high (24%)
	RR high (21%)	HR low (36%)	SPO2 low (20%)
	RR low (14%)	HR high (10%)	BP low (17%)
D	SPO2 low (24%)	SPO2 low (44%)	Arrhythmia (31%)
	HR high (19%)	HR low (14%)	SPO2 low (18%)
	RR high (17%)	RR low (14%)	HR high (13%)
E	SPO2 low (38%)	SPO2 low (48%)	SPO2 low (26%)
	RR high (15%)	RR high (28%)	Arrhythmia (20%)
	HR high (15%)	RR low (9%)	HR high (15%)

NOTE: Abbreviations: HR, heart rate; MSU, medical-surgical unit; NICU, neonatal intensive care unit; PICU, pediatric intensive care unit; RR, respiratory rate; SPO2, oxygen saturation.

DISCUSSION

Physiologic monitor alarm rates and the proportion of patients monitored varied widely between unit types and among the tertiary-care children's hospitals in our study. We found that among MSUs, the hospital with the lowest proportion of beds monitored had the highest alarm rate, with over triple the rate seen at the hospital with the lowest alarm rate. Regardless of unit type, a small subgroup of patients at each hospital contributed a disproportionate share of alarms. These findings are concerning because of the patient morbidity and mortality associated with alarm fatigue[1] and the studies suggesting that higher alarm rates may lead to delays in response to potentially critical alarms.[2]

We previously described alarm rates at a single children's hospital and found that alarm rates were high both in and outside of the ICU areas.[5] This study supports those findings and goes further to show that alarm rates on some MSUs approached rates seen in the ICU areas at other centers.[4] However, our results should be considered in the context of several limitations. First, the 5 study hospitals utilized different bedside monitors, equipment, and software to collect alarm data. It is possible that this impacted how alarms were counted, though there were no technical specifications to suggest that results should have been biased in a specific way. Second, our data did not reflect alarm validity (ie, whether an alarm accurately reflected the physiologic state of the patient) or factors outside of the number of

patients monitored – such as practices around ICU admission and transfer as well as monitor practices such as lead changes, the type of leads employed, and the degree to which alarm parameter thresholds could be customized, which may have also affected alarm rates. Finally, we excluded alarm types that were not consistently collected at all hospitals. We were also unable to capture alarms from other alarm-generating devices, including ventilators and infusion pumps, which have also been identified as sources of alarm-related safety issues in hospitals.[9-11] This suggests that the alarm rates reported here underestimate the total number of audible alarms experienced by staff and by hospitalized patients and families.

While our data collection was limited in scope, the striking differences in alarm rates between hospitals and between similar units in the same hospitals suggest that unit- and hospital-level factors—including default alarm parameter threshold settings, types of monitors used, and monitoring practices such as the degree to which alarm parameters are customized to the patient's physiologic state—likely contribute to the variability. It is also important to note that while there were clear outlier hospitals, no single hospital had the lowest alarm rate across all unit types. And while we found that a small number of patients contributed disproportionately to alarms, monitoring fewer patients overall was not consistently associated with lower alarm rates. While it is difficult to draw conclusions based on a limited study, these findings suggest that solutions to meaningfully lower alarm rates may be multifaceted. Standardization of care in multiple areas of medicine has shown the potential to decrease unnecessary utilization of testing and therapies while maintaining good patient outcomes.[12-15] Our findings suggest that the concept of positive deviance,[16] by which some organizations produce better outcomes than others despite similar limitations, may help identify successful alarm reduction strategies for further testing. Larger quantitative studies of alarm rates and ethnographic or qualitative studies of monitoring practices may reveal practices and policies that are associated with lower alarm rates with similar or improved monitoring outcomes.

CONCLUSION

We found wide variability in physiologic monitor alarm rates and the proportion of patients monitored across 5 children's hospitals. Because alarm fatigue remains a pressing patient safety concern, further study of the features of high-performing (low-alarm) hospital systems may help identify barriers and facilitators of safe, effective monitoring and develop targeted interventions to reduce alarms.

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Teaching Physical Examination to Medical Students on Inpatient Medicine Teams: A Prospective, Mixed-Methods Descriptive Study

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Physical examination (PE) is a core clinical competency, and the internal medicine clerkship is a premiere venue for students to develop PE skills. However, clinical rotations often lack opportunities for real-time instruction. We sought to measure the frequency, content, and factors affecting PE instruction during the internal medicine clerkship. We conducted a prospective mixed-methods study at a single academic center. Data were gathered by a student researcher who directly observed inpatient teams over 3 months. We quantified the frequency of PE teaching activities and analyzed daily written observations using qualitative content analysis. PE was most frequently discussed during bedside rounds and least often during workroom rounds. Direct observation of students' examinations rarely occurred. Multiple factors in the learning environment were posited to affect PE instruction. In brief, we found that residents and attending physicians who are part of internal medicine teaching services do not routinely emphasize PE instruction. *Journal of Hospital Medicine* 2018;13:399-402. © 2018 Society of Hospital Medicine

Physical examination (PE) is a core clinical skill in undergraduate medical education.[1] Although the optimal approach to teaching clinical skills is debated, robust preclinical curricula should generally be followed by iterative skill development during clinical rotations.[2,3]

The internal medicine rotation represents a critical time to enhance PE skills. Diagnostic decision making and PE are highly prioritized competencies for the internal medicine clerkship,[4] and students will likely utilize many core examination skills[1,2] during this time. Bedside teaching of PE during the internal medicine service also provides an opportunity for students to receive feedback based on direct observation,[5] a *sine qua non* of competency-based assessment.

Unfortunately, current internal medicine training environments limit opportunities for workplace-based instruction in PE. Recent studies suggest diminishing time spent on bedside patient care and teaching, with computer-based "indirect patient care" dominating much of the clinical workday of internal medicine services.[6-8] However, the literature does not delineate how often medical students are enhancing their PE skills during clinical rotations or describe how the educational environment may influence PE teaching.

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We aimed to describe the content and context of PE instruction during the internal medicine clerkship workflow. Specifically, we sought to explore what strategies physician team members used to teach PE to students. We also sought to describe factors in the inpatient learning environment that might explain why physical examination (PE) instruction occurs infrequently.

METHODS

We conducted a prospective mixed-methods study using time motion analysis, checklists on clinical teaching, and daily open-ended observations written by a trained observer from June through August 2015 at a single academic medical center. Subjects were recruited from internal medicine teaching teams and were allowed to opt out. Teaching teams had 2 formats: (1) traditional team with an attending physician (hospitalist or general internist), a senior resident, 2 interns, a fourth-year medical student, and 2 third-year students or (2) hospitalist team in which a third-year student works directly with a hospitalist and advanced practitioner. The proposal was submitted to the Medical College of Wisconsin Institutional Review Board and deemed exempt from further review.

All observations were carried out by a single investigator (A.T.), who was a second-year medical student at the time. To train this observer and to pilot the data collection instruments, our lead investigator (P.B.) directly supervised our observer on 4 separate occasions, totaling over 12 hours of mentored co-observation. Immediately after each training session, both investigators (A.T. and P.B.) debriefed to compare notes, to review checklists on recorded observations, and to discuss areas of uncertainty. During the training period, formal metrics of agreement (eg, kappa coefficients) were not gathered, as data

collection instruments were still being refined.

Observation periods were centered on third-year medical students and their interactions with patients and members of the teaching team. Observed activities included pre-rounding, teaching rounds with the attending physician, and new patient admissions during call days. Observations generally occurred between the hours of 7 AM and 6 PM, and we limited periods of observation to 3 consecutive hours to minimize observer fatigue. Observation periods were selected to maximize the number of subjects and teams observed, to adequately capture pre-rounding and new admissions activities, and to account for variations in rounding styles throughout the call cycle. Teams were excluded if a member of the study team was an attending physician on the clinical team or if any member of the patient care team had opted out of the study.

Data were collected on paper checklists that included idealized bedside teaching activities around PE. Teaching activities were identified through a review of relevant literature[9,10] and were further informed by our senior investigator's own experience with faculty development in this area[11] and team members' attendance at bedside teaching workshops. At the end of each day, our observer also wrote brief observations that summarized factors affecting bedside teaching of PE. Checklist data were transferred to an Excel file (Microsoft), and written observations were imported into NVivo 10 (QRS International, Melbourne, Australia) for coding and analysis.

Checklist data were analyzed using simple descriptive statistics. We compared time spent on various types of rounding using ANOVA, and we used a Student two-tailed t-test to compare the amount of time students spent examining patients on pre-rounds versus new admissions. To ascertain differences in the frequency of PE teaching activities by location, we used chi-squared tests. Statistical analysis was performed using embedded statistics functions in Microsoft Excel. A *P* value of <.05 was used as the cut-off for significance.

We analyzed the written observations using conventional qualitative content analysis. Two investigators (A.T. and P.B.) reviewed the written comments and used open coding to devise a preliminary inductive coding scheme. Codes were refined iteratively, and a schema of categories and nodes was outlined in a codebook that was periodically reviewed by the entire research team. The coding investigators met regularly to ensure consistency in coding, and a third team member remained available to reconcile significant disagreements in code definitions.

RESULTS

Eighty-one subjects participated in the study: 21 were attending physicians, 12 residents, 21 interns, 11 senior medical students, and 26 junior medical students. We observed 16 distinct inpatient teaching teams and 329 unique patient-related events (discussions and/or patient-clinician encounters), with most events being observed during attending rounds (269/329, or 82%). There were 123 encounters at the bedside, averaging 7 minutes; 43 encounters occurred in the hallway, averaging 8 minutes each; and 163 encounters occurred in a workroom and averaged 7 minutes per patient discussion. We also observed 28 student-patient encounters during pre-round activities and 30 student-patient encounters during new admissions.

Teaching and Direct Observation

During attending rounds at the bedside, the attending physician examined the patient 82 times out of 123 patient encounters (67%). Teaching activities during these PEs were mostly limited to the attending physician or senior resident noting findings (37 instances out of 82 examinations, or 45%). Rarely did the teacher ask students to re-examine the patient before revealing relevant findings (5 instances out of 82 examinations, or 6%), and only during 15% of bedside examinations did the attending physician directly observe students performing a portion of the PE. As demonstrated in Table 1, discussions at the bedside were more likely to reference the PE ($P < .001$, chi-squared) and more often resulted in specific plans to verify physical findings ($P < .001$, chi-squared) compared with patient-related discussions in other settings. The location of rounding activities, however, did not affect how often teams incorporated PE into clinical decision-making ($P = .82$).

During 28 pre-rounding encounters, students usually examined the patient (26 out of 28 instances, 93%) but were observed only 4 times doing so (out of 26 instances, or 15%). During 30 new patient admissions, students examined 27 patients (90%) and had their PE observed 6 times (out of 27 instances, or 22%). There were no significant differences in frequency of these activities ($P > .05$, chi-squared) between pre-rounds or new admissions.

Observations on Teaching Strategies

In the written observations, we categorized various methods being used to teach PE. Bedside teaching of PE most often involved teachers simply describing or discussing physical findings (42 mentions in observations) or verifying a student's reported findings (15 mentions). Teachers were also observed to use bedside teaching to contextualize findings (13 mentions), such as relating the quality of bowel sounds to the patient's constipation or to discuss expected pupillary light reflexes in a neurologically intact patient. Less commonly, attending physicians narrated steps in their PE technique (9 mentions). Students were infrequently encouraged to practice a specific PE skill again (7 mentions) or allowed to re-examine and reconsider their initial interpretations (5 mentions).

Our written observations also identified factors that may impact clinical instruction of PE as shown in Table 2. In the learning environment, physical space, place, and timing of teaching moments all impacted PE teaching on the wards. Clinical workload and a focus on efficiency appeared to diminish the quality of PE instruction, such as by limiting the number of participants or by leading teams to conduct "sit-down rounds" in workrooms.

DISCUSSION

This observational study of clinical teaching on internal medicine teaching services demonstrates that PE teaching is most likely to occur during bedside rounding. However, even in bed-

TABLE 1. **Clinical and Teaching Activities on Attending Rounds**

		Other Settings		
	Bedside	**Hallway**	**Workroom**	**P Vvalues (Bedside vs. Other Settings)[a]**
Total encounters	123	43	163	
Total time spent rounding per patient	7 minutes	8 minutes	7 minutes	Not significant
Mentioned or performed PE	82 (66%)	24 (56%)	72 (44%)	*P* = .0008
When PE was mentioned or performed, team…				
Noted important PE findings to verify	37/82 (45%)	3/24 (13%)	5/72 (7%)	P < .00001
Incorporated PE into patient care and clinical decision-making	16/82 (20%)	5/24 (21%)	17/72 (24%)	Not significant

[a]*P* values calculated by chi-squared tests. NOTE: Abbreviation: PE, physical examination.

TABLE 2. **Key Factors in the Clinical Environment That May Have Influenced PE Instruction**

Variable	**Relationship to PE Instruction with Salient Example**
Physical space and location	The bedside appears to be the ideal location for PE teaching. Example: Direct observation with real-time feedback by the attending was only seen in this setting.
Number of participants	Bedside PE instruction may be more common with one-on-one interactions. Example: A junior student noted that being on hospitalist service provided more opportunities for patient care responsibilities and a more intimate dynamic for bedside teaching.
Timing	Teaching about PE may be more effective immediately prior to the actual patient encounter. Example: Attending reviewed the pathophysiology of heart failure in the hallway immediately before visiting the patient.
Patient participation	There is a tendency to dismiss physical findings when discussed away from the patient. Example: Teams appeared to brush over "disembodied" findings during post-call conference room presentations.
Clinical workload	Clinical efficiency by house officers is prioritized over directly observing students. Example: An intern typed a new admission note and put in orders while the junior student interviewed and examined the patient.
Access to technology	Appropriately used technology can potentially enhance PE teaching. Example: A fourth-year student showed the team a picture of a sacral wound that he took on his smartphone.

NOTE: Abbreviation: PE, physical examination.

side encounters, most PE instruction is limited to physician team members pointing out significant findings. Although physical findings were mentioned for the majority of patients seen on rounds, attending physicians infrequently verified students' or residents' findings, demonstrated technique, or incorporated PE into clinical decision making. We witnessed an alarming dearth of direct observation of students and almost no real-time feedback in performing and teaching PE. Thus, students rarely had opportunities to engage in higher-order learning activities related to PE on the internal medicine rotation.

We posit that the learning environment influenced PE instruction on the internal medicine rotation. To optimize inpatient teaching of PE, attending physicians need to consider the factors we identified in Table 2. Such teaching may be effective with a more limited number of participants and without distraction from technology. Time constraints are one of the major perceived barriers to bedside teaching of PE, and our data support this concern, as teams spent an average of only 7 minutes on each bedside encounter. However, many of the strategies observed to be used in real-time PE instruction, such as validating the learners' findings or examining patients as a team, naturally fit into clinical routines and generally do not require extra thought or preparation.

One of the key strengths of our study is the use of direct observation of students and their teachers. This study is unique in its exclusive focus on PE and its description of factors affecting PE teaching activities on an internal medicine service. This observational, descriptive study also has obvious limitations. The study was conducted at a single institution during a limited time period. Moreover, the study period June through August, which was chosen based on our observer's availability, includes the transition to a new academic year (July 1, 2015) when medical students and residents were becoming acclimated to their new roles. Additionally, the data were collected by a single re-

searcher, and observer bias may affect the results of qualitative analysis of journal entries.

In conclusion, this study highlights the infrequency of applied PE skills in the daily clinical and educational workflow of internal medicine teaching teams. These findings may reflect a more widespread problem in clinical education, and replication of our findings at other teaching centers could galvanize faculty development around bedside PE teaching.

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Poor Adherence to Risk Stratification Guidelines Results in Overuse of Venous Thromboembolism Prophylaxis in Hospitalized Older Adults

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Venous thromboembolism (VTE) prophylaxis is an important consideration for every older adult admitted to the hospital[1] but should not be prescribed to all patients. Use of anticoagulants (specifically low-molecular-weight heparin, low-dose unfractionated heparin, and fondaparinux) when not medically indicated may be harmful, especially for older adults who on average have more chronic conditions,[1] take more potentially interacting medications,[2] and have higher risks of bleeding.[3] The American College of Chest Physicians (ACCP) Ninth Edition Guidelines for Antithrombotic Therapy and Prevention of Thrombosis explicitly recommend a risk-stratification approach using the Padua Prediction Score (PPS) to select those patients most likely to benefit from VTE prophylaxis.[4,5] This study aimed to describe the use of risk stratification and pharmacologic VTE prophylaxis use in a population of medically ill, hospitalized older patients.

METHODS

We conducted a retrospective cohort study using data from patients aged 70 years or older admitted to Duke University Hospital general medicine services between January 1, 2014, to December 31, 2014. The PPS variables, 11 in total, are each weighed and sum to a score that stratifies patients into either high or low risk for VTE occurrence.[5] Manual chart abstraction was performed using the electronic health record (EHR) to determine each patient's PPS, inpatient pharmacologic VTE prophylaxis use, and contraindications to VTE prophylaxis. Descriptive statistics are presented for the important confounders/covariates, VTE risk, and VTE prophylaxis use.

RESULTS

Of the total eligible cohort (N = 1,399), 400 patients were randomly selected for manual chart review; 89 of these patients were not eligible because they were on anticoagulation upon admission, leaving n = 311 patients in the analytic sample. Mean age for the sample was 80.6 years (standard deviation [SD]: 7.3); 42% were male and 34% were African American, and median length of stay was 4.0 days. The overall mean PPS for the sample was 3.6 (SD 1.8), resulting in 59% (n = 182) defined as "low risk." Reasons for admission, median length of stay, and aspirin use did not differ between the risk groups.

Pharmacological VTE prophylaxis was present in 74% (134 out of 182) of low-risk patients and 71% (92 out of 129) of high-risk patients (Figure). In both low- and high-risk patients who received pharmacological VTE prophylaxis, over 90% had the therapy initiated within 24 hours of admission, and it was continued for over 60% of their hospital days.

DISCUSSION

We found no association between PPS and use of anticoagulants for VTE prophylaxis, suggesting that risk stratification is not being used to guide clinical decision-making. There are several barriers to implementing guideline directed use of VTE risk stratification. First, there is a lack of consensus on which VTE risk assessment tool is best to use with medically ill, hospitalized patients. While the ACCP Ninth Edition Guidelines support the use of the PPS, the American College of Physicians does not recommend a specific tool for VTE risk assessment.[5,6] Although other risk stratification tools exist, concordance between these tools has not been well studied.[7] Second, manual calculation of the PPS can be cumbersome, error prone, and disruptive to the clinical workflow. Automated data extraction leveraging existing structured data elements in the EHR may be particularly attractive to many health systems striving to use EHRs to improve care. Designing and testing automatically populated VTE risk stratification tools may facilitate translation of evidence-based guidelines into routine clinical practice. Lastly, a key barrier is clinician education and awareness about these tools. Adding risk stratification tools to admission order sets is one way to increase clinician awareness and has been shown to decrease inappropriate VTE prophylaxis use.[8] High-quality studies that use implementation science to promote uptake and efficacy of risk stratification tools into clinical practice are urgently needed.

Our study has several limitations. First, this was a single-site study at an academic center, which may limit generalizability of the findings. However, our design enabled us to look at other specific

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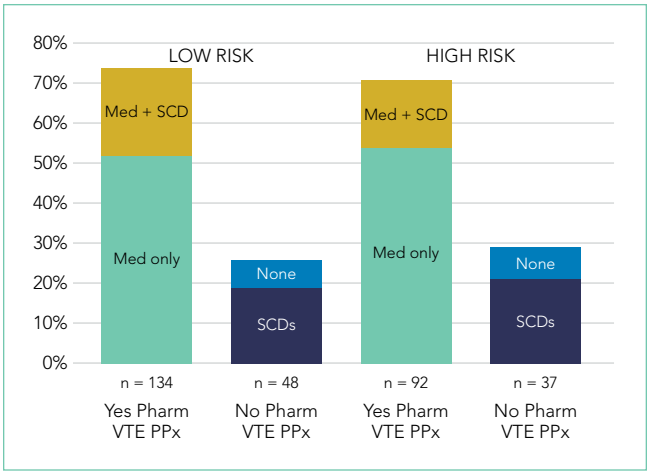

FIG. Indicates the percentage of low-risk and high-risk patients receiving pharmacological venous thromboembolism prophylaxis (either medication alone or in combination with sequential compression devices) or no pharmacological venous thromboembolism prophylaxis (either sequential compression devices only or no prophylaxis). Abbreviations: Med, medication; Pharm, pharmacologic; PPX, prophylaxis; SCD, sequential compression devices; VTE, venous thromboembolism.

patient-level data that is typically not available in larger databases. Second, determination of PPS is limited to data available in the EHR, resulting in measurement error and possibly the underreporting of risk factors. Finally, due to feasibility and the low probability of VTE, we did not collect data on long-term VTE outcome and were unable to determine the impact that inappropriate VTE prophylaxis use has in low-risk hospitalized older adults.

In summary, we found poor adherence to risk stratification guidelines among medically ill, hospitalized older adults, resulting in overuse of anticoagulants for VTE prophylaxis. Automating risk stratification tools and incorporating results into order sets may ensure that adequate prophylaxis is used for patients who need it, while minimizing excess prophylaxis in those who do not.

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Inpatient Portals for Hospitalized Patients and Caregivers: A Systematic Review

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Patient portals, web-based personal health records linked to electronic health records (EHRs), provide patients access to their healthcare information and facilitate communication with providers. Growing evidence supports portal use in ambulatory settings; however, only recently have portals been used with hospitalized patients. Our objective was to review the literature evaluating the design, use, and impact of inpatient portals, which are patient portals designed to give hospitalized patients and caregivers inpatient EHR clinical information for the purpose of engaging them in hospital care. Literature was reviewed from 2006 to 2017 in PubMed, Web of Science, CINALPlus, Cochrane, and Scopus to identify English language studies evaluating patient portals, engagement, and inpatient care. Data were analyzed considering the following 3 themes: inpatient portal design, use and usability, and impact. Of 731 studies, 17 were included, 9 of which were published after 2015. Most studies were qualitative with small samples focusing on inpatient portal design; 1 nonrandomized trial was identified. Studies described hospitalized patients' and caregivers' information needs and design recommendations. Most patient and caregiver participants in included studies were interested in using an inpatient portal, used it when offered, and found it easy to use and/or useful. Evidence supporting the role of inpatient portals in improving patient and caregiver engagement, knowledge, communication, and care quality and safety is limited. Included studies indicated providers had concerns about using inpatient portals; however, the extent to which these concerns have been realized remains unclear. Inpatient portal research is emerging. Further investigation is needed to optimally design inpatient portals to maximize potential benefits for hospitalized patients and caregivers while minimizing unintended consequences for healthcare teams. *Journal of Hospital Medicine* 2018;13:405-412. Published online first December 20, 2017. © 2018 Society of Hospital Medicine

Engaging patients and their caregivers in care improves health outcomes[1-3] and is endorsed by leading healthcare organizations as essential to improving care quality and safety.[4-6] Patient engagement emphasizes that patients, caregivers, and healthcare providers work together to "promote and support active patient and public involvement in health and healthcare and to strengthen their influence on healthcare decisions."[7] Patient portals, web-based personal health records linked to electronic health record (EHR) data, are intended to promote engagement by providing patients and their caregivers with timely electronic access to their healthcare information and supporting communication through secure messaging with their healthcare team.[8] The use of patient portals has also been suggested as a way for patients and/or caregivers to identify and intercept medical errors, thus having the potential to also improve patient safety.[8,9]

As a requirement for meaningful use, access to health information through patient portals in the ambulatory setting has increased dramatically.[10] Studies evaluating the use of these patient portals to promote patient-centered care are growing, but evidence supporting their impact on improved health outcomes is currently insufficient.[11-15] Although research and policy focus on the use of patient portals in the ambulatory setting, recent literature suggests that patient portals may be used to share inpatient clinical information to engage patients and their caregivers during their hospitalization.[16-18] Before the widespread use of patient portals in the inpatient setting is endorsed, systematic research is needed to understand optimal portal design requirements, if and how these portals are used, and whether their use provides value to the hospitalized patient and/or caregiver.[8]

Prior literature summarized early findings regarding the use of various technologies designed to engage hospitalized patients.[17,19,20] In this systematic review, we describe the emerging literature examining the design, use, and impact of inpatient portals for hospitalized patients and/or caregivers over the last 10 years. Inpatient portals are defined here as electronic patient portals tethered to EHRs that are designed to provide hospitalized patients and/or caregivers secure access to personalized, inpatient clinical information with the intent

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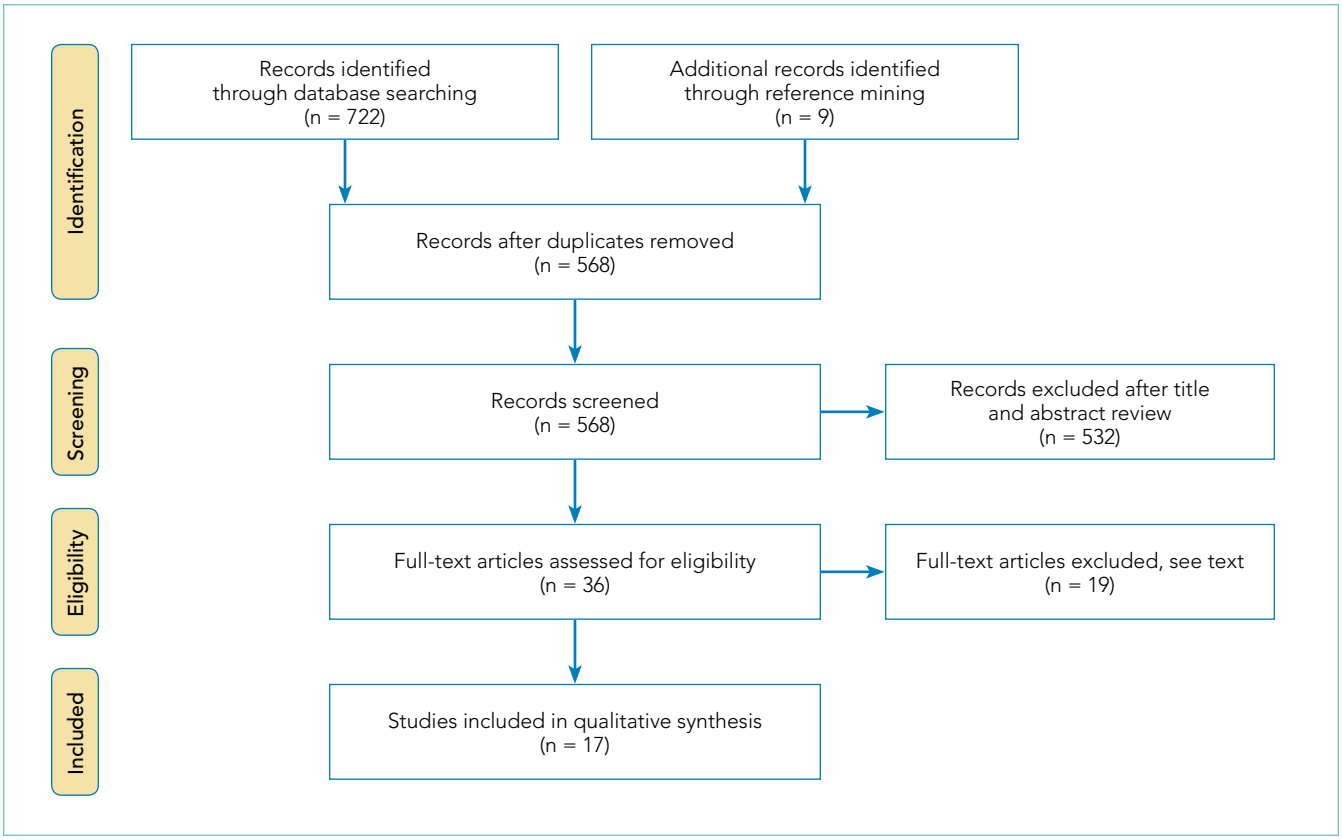

FIG. Article selection flow chart adapted from Moher D, Liberati A, Tetzlaff J, Altman DG; PRISMA Group. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *BMJ*. 2009;339:b2535.

of engaging them in their hospital care. After analyzing and summarizing these data, we then identify knowledge gaps and potential future research directions.

METHODS

Search Strategy, Study Selection, and Analysis

This systematic review included available, peer-reviewed, and grey literature published from January 1, 2006, to August 8, 2017, in PubMed, Web of Science (including the Institute of Electrical and Electronics Engineers Xplore), Cochrane, CINAHLPlus, and Scopus databases. Terms and phrases, including those found in the Medical Subject Heading (MeSH) index, were used to identify studies evaluating (1) patient portals ("health record, personal [MeSH]," "personal health record," "patient portal," "inpatient portal," "ipad," "tablet," or "bedside information technology"), (2) engagement ("engagement," "empowerment," "participation," "activation," or "self-efficacy"), and (3) in the hospital ("inpatient [MeSH]," "hospital [MeSH]," "hospitalized patient [MeSH]," or "unit"). MeSH terms were used when applicable. Based on previous literature, free-text terms were also used when subject headings were not applied consistently, such as with terms related to engagement.[17,21] Studies were excluded if they were not written in English, if they evaluated portals exclusively in the emergency department or ambulatory setting, and/or if they described future study protocols. Studies describing general inpatient technology or evaluating portals used in the hospital but not tethered to inpatient EHR clinical data were also excluded.

By using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines,[22] 2 researchers (M.K. and P.H.) completed the literature search and potential article screening. Results were aggregated and studies were screened and excluded from full review based on title and abstract information. Additional studies were included after reference list review. During a full review of included studies, 2 researchers independently extracted data, including the study objective, design, setting, sample, data collection instruments, outcomes, and a description of results. Guided by our study objective, findings were reconciled by consensus and analyzed and described according to the following 3 themes: (1) inpatient portal design, (2) inpatient portal use and usability, and (3) the impact of inpatient portal use on patient or caregiver and healthcare team outcomes as defined by retrieved studies.

The quality of studies was evaluated by the same 2 researchers independently by using the Downs and Black checklist for assessing the methodological quality of randomized and nonrandomized healthcare interventions.[23] Qualitative studies describing the development of portal prototypes and/or portal redesign efforts were excluded from these analyses. Discrepancies were resolved by consensus. Because of the wide variability in study designs, populations, and outcomes, a meta-analysis of pooled data was not performed.

TABLE 1. **Summary of Inpatient Portal Literature Included**

Authors, year	Study Objectives	Study Design	Sample	Results
Vawdrey et al., 2011[16]	To assess patient's knowledge of inpatient care and usefulness of portal prototype	Qualitative, interviews	5 postop patients on the cardiac unit	Patients perceived portal use would improve satisfaction and engagement. They found it useful but had varying levels of comfort using it. Patients identified unmet needs, including the ability to send messages, give feedback, enter outpatient medications, and see additional information about their healthcare team.
Weyand et al., 2011[24]	To develop, implement, and evaluate the usability of a NICU decision support tool	Qualitative, multiphase	Neonatal experts; 8 parents of former NICU patients	Parents found the portal easy to use, would use the tool, and made suggestions for improvement, such as a glossary describing medications and side effects.
Caligtan et al., 2012[25]	To identify data elements to define requirements for a bedside communication tool prototype	Qualitative, multiphase	41 healthcare team members, 7 inpatients; 30 nurses, 30 inpatients	37 information requirements were identified. Patients indicated the need for a daily plan, schedule, recovery goals, and room/hospital information. Nurses were more interested in safety. Other information requested included discharge information, education, medications, and healthcare team names/photos.
Wilcox et al., 2012[26]	To assess needs of patients to inform the design of inpatient medication electronic views	Qualitative, interviews	11 inpatients, 6 nurses on cardiac step-down unit	Patients and nurses agreed on value. General themes emerged regarding the need for medication tracking, progress, decision-making, education, information, and formatting. Patients indicated the need for information about medication dosage, frequency, administration, photos, criticality, and education (alternatives, indications, side effects).
Dykes et al., 2013[27]	To build and test an electronic bedside communication center prototype	Qualitative, multiphase	Patients/caregivers, volunteers; 8 inpatients, 3 families	Most participants would use the prototype, were satisfied with it, and found it useful and easy to use. Recommendations for improvement were made, including the need to involve the patient in communication and development of the care plan.
Dykes et al., 2014[28]	To identify workflow and design enhancements of an electronic bedside communication center to develop a patient-centered toolkit	Qualitative, multiphase	12 advisory council; 18 nurses, 10 physicians; 5 inpatients, 2 families	Participants confirmed prior needs (above). Participants desired tools within the portal to communicate their goals, problems, concerns, and care preferences directly with the care team along with giving feedback on how well the care team was assisting them to meet these goals.
Pell et al., 2015[29]	To evaluate patient and healthcare team experiences using a portal before and after implementation	Before and after study without control	50 inpatients, 28 clinicians, 14 nurses	Patients who used it were positive about it improving empowerment, understanding, reassurance, and their ability to follow health recommendations. Patients didn't report having more knowledge about discharge timing. Most clinicians thought it would increase their workload and that patients would worry more. These concerns decreased postportal implementation.
Yoo et al., 2015[30]	To design a smart bedside station terminal based on patient/caregiver experiences and healthcare team workflow	Qualitative, multiphase	Multiple inpatients, caregivers, nurses, clinicians, researchers	Participants describe user needs and design components that went in to the development of the bedside terminal. These include information regarding access to inpatient health information and a schedule, addressing privacy issues, integrating into hospital processes, and improving the patient-caregiver relationship.
Dalal et al., 2016[31]	To evaluate a patient-centered toolkit, including enrollment strategy, use and usability, and content of patient-generated messages	Cross-sectional	119 inpatients, 120 caregivers in a medical ICU or oncology unit	Participants found the portal usable, useful, and identified adoption barriers and strategies to promote use. Most frequently used functionalities included goals, results, care team, messages, and medications. 66% and 41% of participants entered a daily and overall goal. Messages included concerns, preferences, needs, and questions.
Kaziunas et al., 2016[32]	To explore the needs of patients/caregivers to design and develop a bone marrow transplant roadmap	Qualitative, observations/interviews	17 caregivers of pediatric bone marrow transplant patients >10 y/o	Participants identified 3 stages of the caregiving experience that may be improved by using the portal: (1) navigating the health system and communicating with the healthcare team, (2) managing caregiving challenges, and (3) transitioning from inpatient to outpatient care.
Kelly et al., 2016[33]	To assess inpatient portal use, parent perceptions of impact on care safety, quality, and communication	Cross-sectional	90 parents of children <12 y/o on medical surgical unit	Most parents were satisfied, found it easy to use and useful, and increased their ability to monitor and care for child. Less perceived it improved communication. 8% found a medication error by using the portal.
Maher et al., 2016[34]	To examine user views, needs, and wants to design and develop bone marrow transplant roadmap	Qualitative, multiphase	11 caregivers, 8 pediatric bone marrow transplant patients >10 y/o	Participants were generally satisfied with functionalities and found the portal useful. Recommendations for improvement were suggested, such as using it to improve the discharge transition through a "continuing the journey" icon and helping with emotional issues.
O'Leary et al., 2016[18]	To assess the effect of using an inpatient portal on patient knowledge and activation	Nonrandomized trial	102 general medical inpatients on control unit, 100 on intervention unit	80% of intervention patients used it, 76% said was easy to use, and 71% said it was useful. More intervention patients could name their physician and role, but patient activation and knowledge of nurse names, planned tests and procedures, and medication changes were not significantly different between groups.
O'Leary et al., 2016[35]	To evaluate patient and provider perceptions of an inpatient portal and identify barriers to use and enhancements	Qualitative, interviews/ focus groups	18 inpatients, 21 providers	Patients found portal information useful and enjoyed entertainment. Patient enhancement suggestions included more information on medications and results and the ability to record questions. Providers perceived that portal use improved engagement but enhancements may overwhelm patients and their communication and workflow.
Wilcox et al., 2016[36]	To evaluate the usability, use, and usefulness of hospital medication tool for patients to inform its redesign	Qualitative, multiphase	20 post-op inpatients, 2 families; 5 pharmacists	An interactive inpatient medication-tracking tool was refined. 70% of patients used it to review medications and log questions and comments. 90% found it useful. Improvements were suggested, such as providing a medication schedule, administration methods, and lay term explanations.
Woollen et al., 2016[37]	To investigate patients' use, experiences, and information needs using an inpatient portal	Qualitative, interviews	14 postop cardiac inpatients and families on a step-down unit	86% of patients used it and 93% wanted more information even if not fully understandable. Most perceived portal use helped address their needs and increased understanding. Most useful features included medications and care team information. Enhancements were suggested, including physician notes, operative reports, medical condition information, test results, and patient-friendly education.
Kelly et al., 2017[38]	To evaluate healthcare team perceptions before and after implementation of a tablet-based inpatient portal	Repeated cross-sectional	94 healthcare team members on general care unit pre- then 70 postimplementation	All healthcare team respondents perceived challenges, including parents would have too many questions, parents would know test results before the healthcare team, staff would be skeptical, and there would not be enough technical support. All perceived challenges were significantly reduced after implementation.

NOTE: Abbreviations: ICU, intensive care unit; NICU, neonatal intensive care unit; y/o, years old.

TABLE 2. **Inpatient Portal Platform, Hardware Used, and Patient and Caregiver-Facing Functionalities Specified in Each Included Study**

Authors, year	Platform	Hardware	Medications	Education or Glossary	Healthcare Team	Schedule	Discharge Information	Test Results	Problem List	Patient/Caregiver Notes	Communication	Food and Diet	Hospital Information	Safety Information	Patient-entered Goals/Pain	Entertainment	Note from Physician	Clinical Trials Information	Virtual Community	Clinical Decision Support	Billing Information
Vawdrey et al., 2011[16]	Custom web-based	Tablet computer	X	X	X	X															
Weyand et al., 2011[24]	Custom web-based		X	X					X								X			X	
Caligtan et al., 2012[25]	Custom web-based		X	X	X	X	X	X		X		X	X								
Wilcox et al., 2012[26]	Pre-prototype																				
Dykes et al., 2013[27]	Custom web-based	Tablet computer	X	X	X	X	X	X		X		X	X	X							
Dykes et al., 2014[28]	Custom web-based	Tablet computer	X	X	X	X	X	X	X		X	X	X	X	X						
Pell et al., 2015[29]		Tablet computer	X				X	X													
Yoo et al., 2015[30]	Custom web-based	Bedside terminal	X	X	X	X	X	X	X	X	X	X	X			X			X		X
Dalal et al., 2016[31]	Custom web-based	Tablet computer	X	X	X	X	X	X	X	X	X	X		X	X						
Kaziunas, et al., 2016[32]	Paper prototype		X	X			X	X				X									
Kelly et al., 2016[33]	Epic MyChart Bedside	Tablet computer	X	X	X	X	X	X	X	X	X										
Maher et al., 2016[34]	Custom web-based	Tablet computer	X	X	X		X	X						X				X			
O'Leary et al., 2016[18]	Custom web-based	Tablet computer	X		X	X			X												
O'Leary et al., 2016[35]	Custom web-based	Tablet computer	X	X	X	X			X							X					
Wilcox et al., 2016[36]	Custom web-based	Tablet computer	X	X	X					X	X										
Woollen et al., 2016[37]	Custom web-based	Tablet computer	X	X	X					X	X				X						
Kelly et al., 2017[38]	Epic MyChart Bedside	Tablet computer	X	X	X	X	X	X	X	X	X										
Total			16	14	13	10	10	10	8	8	8	6	4	4	3	2	1	1	1	1	1

RESULTS

Of the 731 studies identified through database searching and reference review, 36 were included for full-text review and 17 met inclusion criteria (Figure; Table 1). Studies excluded after full-text review described portal use outside of the inpatient setting, portals not linked to hospital EHR clinical data, portals not designed for inpatients, and/or inpatient technology in general. The inpatient portal platforms, hardware used, and functionalities varied within included studies (Table 2). The majority of studies used custom, web-based inpatient portal applications on tablet computers. Most provided information about the patients' hospital medications, healthcare team, and education about their condition and/or a medical glossary. Many included the patient's schedule, hospital problem list,

discharge information, and a way to keep notes.

There has been a recent increase in inpatient portal study publication, with 9 studies published during or after 2016. Five were conducted in the pediatric setting and all but 1[30] with English-speaking participants. Twelve studies were qualitative, many of which were conducted in multiple phases by using semi-structured interviews and/or focus groups to develop or redesign inpatient portals. Of the remaining studies, 3 used a cross-sectional design, 1 used a before and after design without a control group, and 1 was a nonrandomized trial. Studies were rated as having medium-to-high risk of bias because of design flaws (Table 1 in supplementary Appendix). Because many studies were small pilot studies and all were single-centered studies, the generalizability of findings to different healthcare settings or patient populations is limited.

Inpatient Portal Design

Most included studies evaluated patient and/or caregiver information needs to design and/or enhance inpatient portals.[16,24-37] In 1 study, patients described an overall lack of information provided in the hospital and insufficient time to understand and remember information, which, when shared, was often presented by using medical terminology.[30] They wanted information to help them understand their daily hospital routine, confirm and compare medications and test results, learn about care, and prepare for discharge. Participants in multiple studies echoed these results, indicating the need for a schedule of upcoming clinical events (eg, medication administration, procedures, imaging), secure and timely clinical information (eg, list of diagnoses and medications, test results), personalized education, a medical glossary, discharge information, and a way to take notes and recognize and communicate with providers.

Patients also requested further information transparency,[34,37] including physicians' notes, radiology results, operative reports, and billing information, along with general hospital information,[16] meal ordering,[33] and video conferencing.[27] In designing and refining an inpatient medication-tracking tool, participants identified the need for information about medication dosage, frequency, timing, administration method, criticality, alternative medications or forms, and education.[26,36] Patients and/or caregivers also indicated interest in communicating with inpatient providers by using the portal.[16,27,28,30-37] In 1 study, patients highlighted the need to be involved in care plan development,[27] which led to portal refinement to allow for patient-generated data entry, including care goals and a way to communicate real-time concerns and feedback.[28]

Studies also considered healthcare team perspectives to inform portal design.[25,26,28,30,35,37] Although information needs usually overlapped, patient and healthcare team priorities differed in some areas. Although patients wanted to "know what was going to happen to them," nurses in 1 study were more concerned about providing information to protect patients, such as safety and precaution materials.[25] Similarly, when designing a medication-tracking tool, patients sought information that helped them understand what to expect, while pharmacists focused on medication safety and providing information that fit their workflow (eg, abstract medication schedules).[36]

Identified study data raised important portal interface design considerations. Results suggested clinical data should be presented by using simple displays,[28] accommodating real-time information. Participants recommended links[16,29] to personalized patient-friendly[37] education accessed with minimal steps.[26] Interfaces may be personalized for target users, such as patient or proxy and younger or older individuals. For example, older patients reported less familiarity with touch screens, internal keyboards, and handwriting recognition, favoring voice recognition for recording notes.[27] This raised questions about how portals can be designed to best maintain patient privacy.[25] Interface design, such as navigation, also relied heavily on hardware choice, such as tablet versus mobile phone.[28]

Inpatient Portal Use and Usability

Most patient and/or caregiver participants in included studies were interested in using an inpatient portal, used it when offered, found it easy to use, useful, and/or were satisfied with it.[16,18,24-37] Most used and liked functionalities that provided healthcare team, test result, and medication information.[22,33,37] In the 1 identified controlled trial,[18] researchers evaluated an inpatient portal given to adult inpatients that included a problem list, schedule, medication list, and healthcare team information. Of the intervention unit patients, 80% used the portal, 76% indicated it was easy to use, and 71% thought it provided useful information. When a portal was given to 239 adult patients and caregivers in another study, 66% sent a total of 291 messages to the healthcare team.[31] Of these, 153 provided feedback, 76 expressed preferences, and 16 communicated concerns. In a pediatric study, an inpatient portal was given to 296 parents who sent a total of 36 messages and 176 requests.[33] Messages sent included information regarding caregiver needs, questions, updates, and/or positive endorsements of the healthcare team and/or care.

Impact of Inpatient Portal Use

Multiple studies evaluated the impact of inpatient portal use on patient and/or caregiver engagement, empowerment, activation, and/or knowledge, which had mixed results. Most adult patients interviewed in one study had positive experiences using a portal to answer their questions between physician visits and learn about, remember, and engage in care.[37] A majority of adult inpatient portal users in another study agreed that portal use helped them feel in control and understand their condition; however, they did not report having improved discharge timing knowledge.[29] In a pediatric study, most parent inpatient portal users agreed use improved their ability to monitor, understand, and make decisions about their child's care.[33] In the controlled trial,[18] a higher percentage of portal intervention patients could identify their physician or role; however, patient activation was not statistically different between intervention and control patients.

Results from included studies also evaluated the impact of portal use on communication. Some suggest inpatient portal

use may replace and/or facilitate verbal communication between patients, caregivers, and providers.[35] In a pediatric study, 51% of parent portal users reported it gave them the information they needed, reducing the amount of questions they had for their healthcare team.[33] Similarly 43% of 14 adult inpatient portal users in another study thought the portal could replace at least some face-to-face communication.[37] Some providers indicated portal use enhanced rounding discussion quality.[35] Another study suggested that patient-provider communication via electronic messaging may provide benefits for some patients and not others.[37]

Multiple studies evaluated patient, caregiver, and/or healthcare team perceptions of the impact of inpatient portal use on detection of errors and patient safety.[29,31,33,35] In adult inpatients, 6% agreed portal use could help them find errors.[29] In a pediatric study, 8% reported finding at least 1 medication error by using the portal, and 89% thought use reduced errors in their child's care.[33] One patient in a qualitative study of adult inpatients cited an example of a dosing error discovered by using the portal.[37] Healthcare providers in another study also reported that use facilitated patient error identification.[35]

Included studies evaluated the potential impact of portal use on patient anxiety, confusion, and/or worry, and the work of healthcare teams. In 1 study, nurses voiced concerns about giving information subject to change or that couldn't always be achieved because of competing hospital priorities, such as discharge timing.[25] They also worried about giving medical information that would create cognitive overload for patients and/or require professional interpretation. Although providers in another study perceived little negative impact on their workflow after portal implementation, they worried about the potential of adding other information to the portal.[35] For example, they were concerned that the future release of abnormal test results or sensitive data would lead to confusion and more time spent answering patient questions. Physicians also worried that secure messaging could be overused by patients, would be used to inappropriately express acute concerns, or might adversely affect verbal communication. Providers in 2 studies expressed concerns about potential negative implications of portal use on their work before implementation, which were subsequently reduced after portal implementation.[29,38] Conversely, no parent portal users in another study thought portal information was confusing.[33] One parent participant noted portal use may actually decrease anxiety: "Access to their medical information gives patients and their caregivers perspective and insight into their hospital care and empowers them with knowledge about [what is going on], which reduces anxiety."[37]

DISCUSSION

We identified multiple studies evaluating the design, use, and impact of inpatient patient portals for hospitalized patients and caregivers. Based on the information needs identified by patients and healthcare team participants, multiple key content and design recommendations are suggested, including presenting (1) timely, personalized clinical and educational information in lay terms, (2) the care trajectory, including care plan and patient schedule, and (3) a way to recognize and communicate with the inpatient healthcare team. Design challenges still exist, such as translating medical terminology from EHRs into patient-friendly language, proxy access, and portal integration across transitions. Data from identified studies suggest hospitalized patients and caregivers are interested in and willing to use inpatient portals, but there is less information about the use of each functionality. Evidence supporting the role of inpatient portal use in improving patient and/or caregiver engagement, knowledge, communication, and the quality and safety of care is currently limited. Included studies indicate that healthcare team members had concerns about using portals to share clinical information and communicate electronically in the hospital. The extent to which these concerns translate to demonstrable problems remains to be seen.

Early studies focus on patient and caregiver information needs and portal interface design. Although the necessity for certain core functionalities and design requirements are becoming clear,[20] best practices regarding the amount and timing of information released (eg, physician notes, lab results), optimal hardware decisions (eg, large-screen displays, hospital-owned tablets, bring-your-own-device model), and details around secure-messaging implementation in the acute hospital setting are still lacking. Future work is needed to understand optimal patient-provider communication architectures that support improved synchronous and asynchronous messaging and privacy-preserving approaches to the design of these systems to handle patient-generated data as it becomes more commonplace. Although patient participants in these studies were generally satisfied using inpatient portals, many indicated the need for even more transparency, such as the release of results in real time and inclusion of physician notes (even if they could not be fully comprehended).[37] As the movement of sharing notes with patients in the ambulatory setting grows,[39] it will inevitably extend to the inpatient setting.[40] Further research is needed to understand the impact of increased transparency on health outcomes, patient anxiety, and inpatient healthcare team workload. Although the majority of studies described the design and/or use of custom portal platforms, EHR vendors are now developing inpatient portals that integrate into preexisting systems (eg, MyChart Bedside, Epic Systems). This will increase the likelihood of broad inpatient portal adoption and may facilitate multicenter trials evaluating the impact of their use.

The next steps will need to focus on the evaluation of specific inpatient portal functionalities and the impact of their use on objective process and outcome measures by using rigorous, experimental study designs. Akin to ambulatory portal research, measures of interest will include patient activation,[41,42] patient and/or caregiver satisfaction,[43] care processes (eg, length of stay, readmissions), and patient safety (eg, safety perceptions, adverse drug events, hospital-acquired conditions, and diagnostic errors). More than a mechanism for unidirectional sharing information from providers to the patient, inpatient portals will also provide a platform for the reciprocal exchange of information from the patient to the provider through

patient-generated data, such as goal setting and feedback. Patients may play a larger role in reporting hospital satisfaction in real time, reconciling medications, contributing to the treatment plan, and identifying medical errors. As portals are integrated across the care continuum,[20] our understanding of their impact may become more clear.

In this review, only 5 studies were conducted in the pediatric hospital setting.[24,32-34,38] With hospitalized children experiencing 3 times more harm from medical errors than adults,[44] engaging parents in inpatient care to improve safety has become a national priority.[45] Giving patient portals, or "parent portals," to parents of hospitalized children may provide a unique opportunity to share healthcare information and promote engagement, a direction for future study. There is also a research gap in evaluating adolescent inpatient portal use. Future portals may be designed to incentivize young children to learn about their hospitalization through games linked to health-related education.

Finally, as patients and caregivers begin using inpatient portals, there will almost certainly be consequences for healthcare teams. Understanding and anticipating human and work system factors influencing inpatient portal adoption and use from the perspectives of both patients and healthcare teams are needed.[46,47] Engaging healthcare team members as valuable stakeholders during implementation and measuring the impact of portal use on their workload is necessary, especially as portal use spreads beyond pilot units. The success of inpatient portals is dependent upon both the positive benefits for patients and their acceptance by healthcare teams.[48]

Limitations exist in conducting a systematic literature review.[49] The conceptual definition of a portal for hospitalized patients and patient/caregiver engagement is evolving; therefore, our definition may not have captured all relevant studies. We intentionally did not include all inpatient technology, as we were interested in a narrow definition of portals designed for inpatients that provided clinical information from the inpatient EHR. Because of rapid technology changes, we also limited our search to studies published within the last 10 years; prior literature has been described elsewhere.[17] We excluded non-English language studies, limiting our ability to capture the full scope of inpatient portal research. These patients already experience healthcare delivery disparities, widened by the inaccessibility of innovative health information technologies.[50] Future studies would be enhanced with the inclusion of these participants.

Inpatient portal research is in its infancy but growing rapidly. Studies to date are primarily focused on portal design and have small sample sizes. Early findings suggest that patients and caregivers are, in general, enthusiastic about using inpatient portals. Further research is needed, however, to determine the impact of inpatient portal use on patient engagement and hospital-care quality, safety, and cost.

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Immunotherapy-Induced Colitis: An Emerging Problem for the Hospitalist

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Since their introduction for melanoma treatment, the use of immune checkpoint inhibitors (ICIs) has rapidly expanded. Though their impact on survival is irrefutable, these medications have been associated with autoimmune-like adverse events related to their ability to induce the immune system. One of the most commonly affected organ systems is the gastrointestinal (GI) tract, in which manifestations range from mild diarrhea to severe colitis with intestinal perforation. Because of the increased use of ICIs, hospitalists are caring for an increasing number of patients experiencing their adverse events. We present a case-oriented review of the GI adverse events associated with the use of ICIs to familiarize the hospitalist with their mechanism of action and potential complications and to emphasize the importance of early diagnosis and treatment to decrease morbidity and mortality. *Journal of Hospital Medicine* 2018;13: 413-418. Published online first February 7, 2018. © 2018 Society of Hospital Medicine

Immune checkpoint inhibitors (ICIs), a form of immunotherapy, have changed the management of cancer since their introduction in 2011.[1] They were initially tested on melanoma.[2] Their use in the advanced stages of the disease demonstrated a 2-year survival of 18% compared with 5% by using other therapies.[3] Similar results were observed in nonsmall cell lung carcinoma (NSCLC); the overall survival benefit was 3 months with the use of ICIs compared with traditional chemotherapy (42% and 24% at 1 year, respectively).[4] Antitumor activity has also been seen in the treatment of other malignancies, including renal cell carcinoma,[5] bladder carcinoma,[6,7] head and neck carcinoma,[8] colorectal cancer,[9] Hodgkin lymphoma,[10] and, more recently, hepatocellular carcinoma.[11] The use of ICIs has also been linked to serious complications.[12] Although the skin, kidneys, lungs, and endocrine and nervous systems may be affected, complications of the gastrointestinal (GI) tract are frequent and can be life-threatening.[12-16] We performed a thorough review of the literature to familiarize hospitalists with the mechanism of action and uses of ICIs, the clinical presentation of their GI toxicity, and the current recommendations regarding diagnosis and treatment.

CASE PRESENTATION

A 66-year-old man was admitted to our institution with a 1-week history of severe, diffuse abdominal pain and profuse watery diarrhea. He reported having more than 8 watery bowel movements per day and denied fever, recent travel, ill contacts, or ingestion of undercooked food. He had a history of metastatic melanoma and was undergoing treatment with both nivolumab and ipilimumab; the drugs were started 6 weeks prior to presentation. Physical examination revealed a heart rate of 110 beats/minute while supine and 123 beats/minute while standing, blood pressure of 112/69 mm Hg while supine and 92/62 mm Hg while standing, and a temperature of 37.2°C. He was in mild distress and had dry oral mucosa. Abdominal examination revealed hyperactive bowel sounds and mild diffuse abdominal tenderness with no guarding or rebound. His extremities were cool, but peripheral pulses were present. Initial laboratory results included a hemoglobin level of 15.3 g/dL (range 12.0-16.0 mg/dL), white blood cell count 14.2×10^9/L (range 4.5-11.0 $\times 10^9$/L), and platelet count 236×10^9/L (range 150-400 $\times 10^9$/L); other test results included a sodium level of 130 mmol/L (range 135-145 mmol/L), potassium 2.3 mmol/L (range 3.5-5.5 mmol/L), serum creatinine 2.2 mg/dL (range 0.8-1.3 mg/dL), blood urea nitrogen 72 mg/dL (range 8-21 mg/dL), and serum venous lactate 5.9 mmol/L (range 0.9-1.7 mmol/L).

MECHANISM OF ACTION AND USES OF ICIS

T-cell lymphocytes play a pivotal role in acquired immunity, but their function requires an appropriate balance between stimulatory and inhibitory signals to prevent autoimmunity.[17] Immune checkpoint molecules are used by the immune system to assist with this balance.[18] Although several of these molecules exist, the cytotoxic T-lymphocyte antigen-4 (CTLA-4) and programmed cell death-1 (PD-1) are among the most widely studied.[12]

Activation or inhibition of T cells depends on the interaction of their receptors with ligands located on the surface of other cells. Both CTLA-4 and PD-1 are receptors located on the surface of T-cell lymphocytes that inhibit the function of T cells after binding with their ligands.[19-21] Cancer cells often use this mechanism to avoid immune recognition and promote their survival.[18,21,22] Importantly, ligands that bind CTLA-4 are

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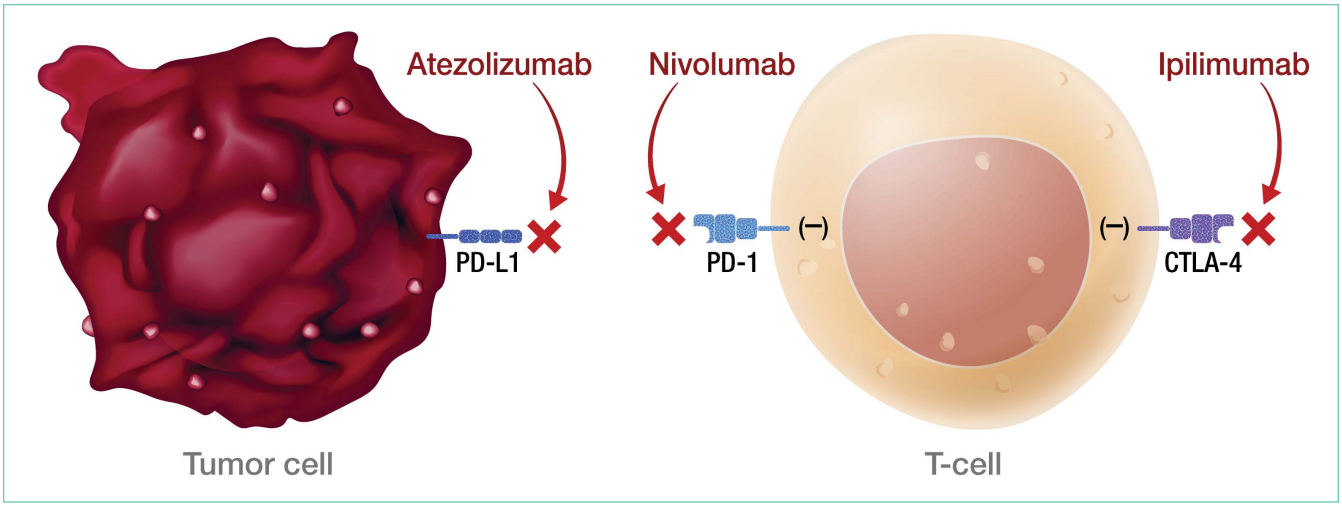

FIG. T-cell interacting with antigen-presenting cells and a tumor cell. PD-1/PD-L1 receptor/ligand and CTLA-4 receptor/ligand interaction lead to negative signal and blockage of T-cell activation. Used with permission of Mayo Foundation for Medical Education and Research. All rights reserved. Abbreviations: CTLA-4, cytotoxic T-lymphocyte antigen-4; PD-1, programmed cell death-1; PD-L1, programmed cell death ligand-1.

expressed by numerous tissues throughout the body, contrary to ligands that bind to PD-1 (PD-L1 or PD-L2), which are more specific to tumor cells (Figure).[21-23] ICIs are monoclonal antibodies that block these pathways and increase T-cell activity.[18]

Ipilimumab is a monoclonal antibody directed against CTLA-4.[24] After demonstrating survival benefits in patients with unresectable and metastatic melanoma, ipilimumab was the first ICI approved for use by the US Food and Drug Administration (FDA).[1,3] Another monoclonal antibody directed against CTLA-4, tremelimumab, is not currently approved for use by the FDA.

Pembrolizumab and nivolumab are monoclonal antibodies against PD-1. The FDA approved them for the treatment of advanced melanoma in 2014[17] and metastatic NSCLC in 2015.[12] Nivolumab was also approved for the treatment of renal cell carcinoma and for advanced-stage melanoma in combination with ipilimumab.[12,17] Atezolizumab, avelumab, and durvalumab are PD-L1 inhibitors. All 3 are approved by the FDA for treatment of advanced urothelial carcinoma.[25-27] Atezolizumab is also approved for the treatment of metastatic NSCLC,[28] and avelumab is approved for treatment of metastatic Merkel cell carcinoma.[29] Table 1 summarizes the medications, their target, and FDA-approved indications.[1,12,17,26,27,29,30]

TABLE 1. **Summary of ICI Target and Indications**

Name of the Drug	Target Receptor	FDA Approval for Use
Ipilimumab (Yervoy)	CTLA-4	Advanced melanoma
Tremelimumab	CTLA-4	Not yet approved
Nivolumab (Opdivo)	PD-1	Advanced melanoma, NSCLC, RCC, cHL, HNSCC, advanced urothelial carcinoma, CRC
Pembrolizumab (Keytruda)	PD-1	Advanced melanoma, NSCLC, HNSCC, cHL, advanced urothelial carcinoma, advanced gastric cancer, microsatellite instability-high cancer
Atezolizumab (Tecentriq)	PD-L1	NSCLC and advanced urothelial cancer
Avelumab (Bavencio)	PD-L1	Metastatic MCC, advanced urothelial cancer
Durvalumab (Imfinzi)	PD-L1	Advanced urothelial carcinoma

NOTE: Table based on references 1, 12, 17, 26, 27, 29, and 30. Abbreviations: cHL, Classical Hodgkin Lymphoma; CRC, colorectal cancer; CTLA-4, cytotoxic T-lymphocyte antigen-4; HNSCC, head and neck squamous cell carcinoma; ICI, immune checkpoint inhibitors; MCC, Merkel cell carcinoma; NSCLC, nonsmall cell lung cancer; PD-1, programmed cell death-1; PD-L1, programmed cell death ligand-1; RCC, renal cell cancer.

TOXIC PROFILE

Because of the sustained T-cell activation, ICIs have been associated with autoimmune-like toxicities known as immune-related adverse events (irAEs).[19,31] Because the PD-1/PD-L1 pathway is more tumor-specific than the CTLA-4 pathway,[21-23] there is a higher incidence of serious irAEs seen with ipilimumab, reported to be around 27%.[18,22] Furthermore, the risk of developing irAEs is dose-dependent and can increase up to 55% when anti-CTLA-4 are used with other ICIs such as nivolumab.[13,32-34]

The skin and GI tract are the most commonly involved organs.[14-16] Skin is affected in 50% of patients receiving ipilimumab and 40% of patients on nivolumab or pembrolizumab, often in the form of a rash or pruritus.[12,35-37] The rash is often described as faintly erythematous, reticular, and maculopapular and typically affects the trunk and extremities.[38] Importantly, these events usually occur within the first 2 weeks of treatment, and fewer than 5% are severe.[12,36,39] A higher percentage of severe adverse events occurs in the GI tract, with a reported incidence of 12%.[3,14,36,39]

CLINICAL PRESENTATION

Although any portion of the GI tract can be affected by ICIs, the lower GI tract is most commonly involved. Clinical signs include watery diarrhea, colitis, and enteritis.[15,19] Less commonly, the upper GI tract is involved, and clinical manifestations include aphthous ulcers, esophagitis, and gastritis.[40,41] GI symptoms usually begin 6 weeks after the initial dose of ICIs and typically follow cutaneous manifestations.[15,20,36,37] However, they can occur as late

TABLE 2. **Common Terminology Criteria for Adverse Events (CTCAEs)**

	Grade				
Adverse Event	**1**	**2**	**3**	**4**	**5**
Diarrhea	Increase of <4 stools per day over baseline; mild increase in ostomy output compared with baseline	Increase of 4-6 stools per day over baseline; IV fluids <24 hours; not interfering with ADL	Increase of ≥7 stools per day over baseline; incontinence; IV fluids ≥24 hours; hospitalization; interfering with ADL	Life-threatening consequences (eg, hemodynamic collapse)	Death
Colitis	Asymptomatic, pathologic, or radiographic findings only	Abdominal pain; mucus or blood in stool	Abdominal pain; fever; change in bowel habits with ileus; peritoneal signs	Life-threatening consequences (eg, perforation, bleeding, ischemia, necrosis, toxic megacolon)	Death

NOTE: Adapted from the Cancer Therapy Evaluation Program, National Cancer Institute (NCI) Common Terminology Criteria for Adverse Events v3.0 (CTCAE).57 Abbreviations: ADL, activities of daily life; IV, intravenous.

as 4 months after the last dose.[19] Watery, nonbloody diarrhea is the most common presentation of GI involvement, occurring in 19% of patients receiving anti-PD-1/PD-L1 and 33% receiving anti-CTLA-4 medications.[19,37] When patients receive both therapies, the incidence rate increases to 44%.[32] The clinical severity of diarrhea can be graded on a scale of 1 to 5 according to the Common Terminology Criteria for Adverse Events (CTCAE) (Table 2).[42] Though most patients have mild disease (grade 1 or 2), close to 3% develop severe diarrhea (grade 3 or higher) with electrolyte disturbances and weight loss.[14,20]

Colitis, defined by either the presence of symptoms or radiologic findings suggestive of inflammation, occurs less often than diarrhea alone, with a reported incidence of 2.3%.[37,43] This incidence increases to almost 12% when anti-CTLA-4 and anti-PD-1/PD-L1 are combined.[32] Colitis symptoms include abdominal pain (20%), nausea and vomiting (15%), fever (12%), and, less often, bloody diarrhea or rectal bleeding.[19,20] Colitis severity is graded according to the CTCAE (Table 2).[42] Most patients have mild colitis (grade 1 or 2).[19] The risk for developing severe colitis (grade 3 or higher) is almost 10 times higher with the use of anti-CTLA-4 compared with anti-PD-1/PD-L1 agents.[43] Patients with severe disease are at risk of developing life-threatening complications, such as ileus, toxic megacolon, bowel ischemia, necrosis, or even perforation, which has been reported in up to 5% of patients with colitis because of ipilimumab.[13,17]

CASE APPROACH STRATEGY

Based on the patient's symptoms, physical findings, and temporal relationship to ICI therapy, he was believed to have immune-mediated colitis. Stool studies, including those looking for ova and parasites, *Clostridium difficile* polymerase chain reaction (PCR), and stool cultures were negative.

DIAGNOSIS

In a patient undergoing ICI treatment who has diarrhea, the initial assessment should exclude *C. difficile* and *Salmonella* by stool culture, PCR, or pathogenic antigens.[19] Cytomegalovirus reactivation should also be considered. Immune-mediated colitis and infection can coexist; thus, a positive infectious etiology does not rule out the presence of immune colitis or vice versa.[44] Fecal calprotectin, a marker of neutrophil-associated inflammation, is nonspecific for ICI-induced colitis; however, it may help to distinguish inflammatory from noninflammatory diarrhea.[33,45]

No clear guideline exists for the use of abdominal imaging. Some experts suggest using computed tomography in patients with severe, persistent, or progressive symptoms in order to exclude bowel obstruction, toxic megacolon, or perforation.[19,46]

In patients with typical symptoms, and after infectious etiologies are ruled out, empiric use of corticosteroids can be initiated without an endoscopic evaluation, which is not necessary to establish a diagnosis and rarely changes management.[12,37,47] In patients with atypical presentations or for whom the diagnosis remains in question, endoscopic evaluation with biopsies may be required. Macroscopic findings may be similar to those seen with inflammatory bowel disease (IBD), including erythema, edema, ulceration, granularity, or loss of vascular pattern. Although immune-mediated colitis affects the descending colon more often than IBD, this feature and any macroscopic findings are insufficient to make this distinction.[20,36] Furthermore, the lack of macroscopic abnormalities does not rule out immune-mediated colitis.[20]

When endoscopic biopsies are obtained, histologic findings for anti-CTLA-4 medications (eg, ipilimumab) usually follow 3 patterns: neutrophilic infiltrate (46%), lymphocytic infiltrate (15%), and mixed infiltrate (38%).[41] Other findings include crypt abscesses and tissue destruction.[20] No biopsy-specific pattern has been described with anti-PD-1/PD-L1 medications, such as nivolumab or pembrolizumab.[18] A normal colonic tissue does not exclude the presence of an irAE, as cases of isolated ileitis[48] or enteritis[49] without colitis can also occur.

CASE MANAGEMENT STRATEGY

The patient was started on intravenous (IV) methylprednisolone 2 mg/kg twice a day. After 48 hours, he still had more than 7 episodes of diarrhea per day, so he was treated with 1 dose of infliximab 5 mg/kg without stopping corticosteroids. Within 72 hours, the patient's abdominal pain improved and his diarrhea stopped. He was discharged on an 8-week taper of prednisone starting at 1 mg/kg/day, pneumocystis pneumo-

TABLE 3. **Management of Colitis Induced by ICI Therapy**

Grade/Other	Management
1	Fluid and electrolyte replacement Colitis diet of the American Dietetic Association Loperamide, diphenoxylate hydrochloride, or atropine sulfate
2	Same as grade 1 If persists >3 days: oral prednisone 0.5-1 mg/kg/day tapered over 4-8 weeks Consider IV corticosteroids if no improvement
3-4	Oral prednisone: 1-2 mg/kg/day ± oral budesonide: 9-12 mg daily If severe symptoms: IV methylprednisolone 2 mg/kg twice a day for 1-2 days before transitioning to oral corticosteroids If no improvement: infliximab 5 mg/kg single dose Continue slow taper of oral prednisone over 4-8 weeks
Refractory disease/ perforation	Consider partial/total colectomy

NOTE: Abbreviation: IV, intravenous.

nia (PCP) prophylaxis was started, and ICI therapy was discontinued indefinitely.

MANAGEMENT OF COLITIS

Several principles should be considered in managing immune-mediated colitis: (1) management for adverse events of anti-CTLA-4 and anti-PD-1/PD-L1 should be the same; (2) though guidelines were made for patients with melanoma, they can be used to treat patients with other types of cancer; and (3) treatment should be started as early as possible, ideally within 5 days of symptom onset, as this hastens clinical improvement and decreases the incidence of complications.[20] Treatment is summarized in Table 3.

Management of grade 1 and 2 colitis is mainly supportive, consisting of fluid and electrolyte replacement, the American Dietetic Association colitis diet, and antimotility agents, such as loperamide, oral diphenoxylate hydrochloride, or atropine sulfate.[36,37] Persistent grade 2 symptoms (lasting >3 days), should prompt initiation of 0.5 to 1 mg/kg/day of oral prednisone or an equivalent.[19] If symptoms do not improve with oral corticosteroids, patient hospitalization for IV corticosteroids should be considered.[37] Importantly, opioids and antidiarrheals may mask the pain and severity of symptoms and, therefore, should be used cautiously.[19]

Patients with grade 3 and 4 colitis (≥7 stools per day, severe abdominal pain, or complications) require the use of systemic corticosteroids at a dose of 1 to 2 mg/kg/day of prednisone or an equivalent.[15] Patients who fail to respond to prednisone alone may benefit from the addition of oral budesonide at a dose of 9 to 12 mg/day.[50] In severe cases of colitis, hospitalization may be necessary for IV hydration, electrolyte replacement, and IV methylprednisolone at a starting dose of 2 mg/kg twice a day for 1 to 2 days before transitioning to oral corticosteroids.[12,15] Though improvement is usually noted within the first 2 weeks of treatment, prednisone should be slowly tapered over a period of 4 to 8 weeks to ensure complete healing and prevent relapse.[20,36] Patients who receive an equivalent dose of prednisone 20 mg daily during a period of 4 weeks or more should receive PCP prophylaxis.[51] Some patients fail to respond to IV corticosteroids despite adequate dosing. Many of these patients have severe disease, possibly because of delayed recognition and initiation of treatment.[19] As with IBD, the addition of infliximab to corticosteroids at 5 mg/kg as a single dose is usually successful for this population subset.[52-54] Although a response is seen within 1 to 3 days,[41] some patients benefit from an additional dose of infliximab 2 weeks after the initial dose.[19] If sepsis or perforation is suspected at any point, corticosteroids or infliximab should be avoided and antibiotics should be started immediately.[15,19] Patients with a medically unresponsive disease may require partial or complete colectomy.[20] The use of prophylactic budesonide to prevent diarrhea or colitis has not been proven effective and should not be used.[55] Despite complications, mortality from colitis has markedly decreased given the increased awareness of this adverse event, reduction in the time to recognition and treatment, and increased adherence to corticosteroids.[12]

Treating physicians may be delayed in starting appropriate therapy because patients are concerned that using corticosteroids will negatively impact immunotherapy efficacy. Current evidence shows that the use of temporary immunosuppression to treat irAEs does not affect overall survival, efficacy, or time to treatment failure of the ICI.[12,56] Restarting ICI therapy is a complex decision and should always be individualized. In grade 1 and 2 colitis, ICI therapy is typically restarted after symptoms have improved.[5] In grade 3 and 4 colitis, ICI therapy is often permanently discontinued.[20]

CONCLUSION

ICIs have not only increased our understanding of the biology of cancer, but they have also improved survival in advanced stages of malignancies like melanoma, NSCLC, and renal cell carcinoma. The expanding use of these medications increases the likelihood that healthcare providers will encounter patients experiencing their adverse events.

Immune-mediated GI adverse events include a wide range of symptoms, from mild diarrhea to severe colitis complicated by perforation and death. Diagnosis requires exclusion of an infectious process. Early recognition and treatment with corticosteroids or another immunosuppressant such as infliximab hastens recovery and decreases complications and mortality. Treatment should be started within 5 days of symptom onset. Corticosteroids should be slowly tapered for no less than 4 weeks to prevent relapse and PCP prophylaxis administered in appropriate patients. Restarting ICI therapy may be considered in cases of mild colitis, but in severe cases, ICI therapy is usually discontinued.

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Update in Hospital Palliative Care: Symptom Management, Communication, Caregiver Outcomes, and Moral Distress

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BACKGROUND: Updated knowledge of the palliative care (PC) literature is needed to maintain competency and best address the PC needs of hospitalized patients. We critiqued the recent PC literature with the highest potential to impact hospital practice.

METHODS: We reviewed articles published between January 2016 and December 2016, which were identified through a handsearch of leading journals and a MEDLINE search. The final 9 articles selected were determined by consensus based on scientific rigor, relevance to hospital medicine, and impact on practice.

RESULTS: Key findings include the following: scheduled antipsychotics were inferior to a placebo for nonterminal delirium; a low-dose morphine was superior to a weak opioid for moderate cancer pain; methadone as a coanalgesic improved high-intensity cancer pain; many hospitalized patients on comfort care still receive antimicrobials; video decision aids improved the rates of advance care planning (ACP) and hospice use and decreased costs; standardized, PC-led intervention did not improve psychological outcomes in families of patients with a chronic critical illness; caregivers of patients surviving a prolonged critical illness experienced high and persistent rates of depression; people with non-normative sexuality or gender faced additional stressors with partner loss; and physician trainees experienced significant moral distress with futile treatments.

CONCLUSIONS: Recent research provides important guidance for clinicians caring for hospitalized patients with serious illnesses, including symptom management, ACP, moral distress, and outcomes of critical illness. *Journal of Hospital Medicine* 2018;13:419-423. Published online first December 20, 2017. © 2018 Society of Hospital Medicine.

The aim of palliative care (PC) is to improve quality of life for patients facing serious, life-threatening illness and their families.[1] Due to insufficient numbers of PC specialists to meet the PC needs for every hospitalized patient,[2] all hospitalists should maintain basic PC skills as recognized by PC being a core competency for hospitalists.[3,4]

We summarize and critique PC research articles published between January 1, 2016, and December 31, 2016, that have a high likelihood of impacting the practice of hospital medicine. We hand searched 15 journals and conducted a MEDLINE keyword search of PC terms (see Table). All titles and/or abstracts were reviewed and selected for full review based on the following factors: palliative medicine content, scientific rigor, impact on practice, and relevance to hospital medicine. Fifty-five articles were individually reviewed and scored by all authors according to rigor, impact, and relevance. Articles were ranked according to their mean scores, and 9 articles were chosen for inclusion through consensus discussion.

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SYMPTOM MANAGEMENT

Antipsychotics Were Inferior to a Placebo in Treating Nonterminal Delirium

Agar MR, Lawlor PG, Quinn S, et al. Efficacy of oral risperidone, haloperidol, or placebo for symptoms of delirium among patients in palliative care: a randomized clinical trial. *JAMA Intern Med*. 2017;177(1):34-42.

Background

Delirium is highly prevalent in PC and is associated with significant distress.[5] Antipsychotics are widely used for symptoms of delirium, although current evidence does not support this practice in hospitalized adults.[6,7]

Findings

This was a double-blind, parallel-arm, placebo randomized

TABLE. **Fifteen Journals Included in Hand Search for Palliative Care Studies Impacting Hospital Medicine Practice**

American Journal of Hospice and Palliative Care
Annals of Internal Medicine
British Medical Journal
Journal of the American Geriatrics Society
Journal of the American Medical Association (JAMA)
JAMA Internal Medicine
Journal of Clinical Oncology
Journal of General Internal Medicine
Journal of Hospital Medicine
Journal of Pain and Symptom Management
Journal of Palliative Medicine
Lancet
New England Journal of Medicine
PC-FACS (Fast Article Critical Summaries for Clinicians in Palliative Care)

Search strategy for review of palliative care studies impacting hospital medicine practice

Medline search for English-language articles published between January 1, 2016, and December 31, 2016

- Palliative
- Pain
- End of life
- Symptom management
- Communication
- Hospice
- Terminal illness
- Advance directives

controlled trial (RCT) of 247 patients with delirium with an estimated life expectancy of ≥7 days in 11 PC or hospice units across Australia. Patients were randomized to receive risperidone, haloperidol, or a placebo in addition to nonpharmacological management of delirium. Delirium symptom scores after 3 days of treatment, the use of midazolam as a rescue medication, and the presence of extrapyramidal symptoms (EPS) were measured. The risperidone and haloperidol arms had significantly higher delirium symptom scores ($P = .02$ and $P = .009$, respectively), mean EPS symptoms ($P < .001$), and more use of rescue midazolam than the placebo arm. Mortality was higher for antipsychotics, with a hazard ratio of 1.73 for haloperidol ($P = .003$), 1.29 for risperidone ($P = .14$), and 1.47 for any antipsychotic ($P = .01$).

Cautions

The study population was elderly (mean age >70 years) with mild delirium scores. The use of antipsychotics was associated with more benzodiazepine use, which could itself worsen delirium. As patients with clinician-predicted life expectancy of <7 days were excluded, findings cannot be extrapolated to the treatment of terminal delirium, which can often be more symptomatic and difficult to treat.

Implications

Avoid scheduled antipsychotics in patients with nonterminal delirium, as they can increase risk of harm without advantages, over nonpharmacologic interventions.

Low-Dose Morphine Was Superior to Weak Opioids in the Treatment of Moderate Cancer Pain

Bandieri E, Romero M, Ripamonti CI, et al. Randomized trial of low-dose morphine versus weak opioids in moderate cancer pain. *J Clin Oncol*. 2016;34(5):436-442.

Background

The World Health Organization guidelines recommend the use of weak opioids (WOs), such as codeine or tramadol, as a sequential step in the management of cancer pain.[8] This strategy has not been tested against low doses of stronger opioids.

Findings

In this multicenter, open-label RCT, 240 patients in Italy were randomized and stratified by age (<75 years or ≥75 years) to either the WO group or low-dose morphine (M) group. The primary outcome measure was a reduction in pain intensity by 20% or more. Secondary outcomes included an improvement in symptom scores, a ≥30% and ≥50% reduction in pain, increased opioid dosage, and adverse side effects. Compared with the WO group, the M group had more patients with a 20% reduction in pain (88.2% vs 54.7%; $P < .001$), more evidence of pain control in the first week (80.9% vs 43.6%; $P < .001$), more patients with a ≥30% and ≥50% reduction in pain, and less need to switch to a stronger opioid (15.5% vs 35.0%; $P = .001$) or require dose increases. Adverse effects were similar in both groups.

Cautions

Patients with chronic kidney disease (CKD) were excluded due to concerns about the accumulation of morphine metabolites. Additionally, this study was open label, increasing the risk of bias.

Implications

Low-dose morphine should be considered over the use of WOs to achieve better and more rapid pain control in patients without CKD.

The Use of Methadone as a Coanalgesic May Improve Moderate Cancer Pain

Courtemanche F, Dao D, Gagné F, et al. Methadone as a coanalgesic for palliative care cancer patients. *J Palliat Med*. 2016;19(9):972-978.

Background

Methadone is effective at treating cancer pain and is often utilized when patients have neuropathic pain, fail to respond to traditional opioids, or have renal failure.[9,10] However, its long half-life and many drug interactions make methadone challenging to use.

Findings

This cohort study looked at 153 inpatient or outpatient PC patients in Montreal who received methadone as a coanalgesic for cancer pain. The patients' median morphine equivalent dose was 120 mg when initiating methadone. The median starting dose of methadone was 3 mg per day. Of patients, 49.3% had a significant response (≥30% pain reduction), with a median response time of 7 days, and 30.1% achieved a substantial response (≥50% pain reduction), with a median response time of 3 days. Patients with higher initial pain scores were more likely to respond to adjuvant methadone. Those who had not responded after a week of methadone were unlikely to respond despite dose escalations. Adverse effects included drowsiness (51.4%), confusion (27.4%), constipation (24.7%), nausea (19.9%), and myoclonia (16.4%).

Cautions

This was an observational study with retrospective data, leading to higher levels of missing data. A high rate of adverse side effects was reported (90.4%). Further study is needed to validate and reproduce the findings.

Implications

The use of adjuvant low-dose methadone may be considered in patients with moderate pain despite high-dose opioids. If a response is not seen within 7 days, then methadone use should be reconsidered.

ANTIBIOTIC STEWARDSHIP

Many Hospitalized Patients on Comfort Care Still Receive Antimicrobials

Merel SE, Meier CA, McKinney CM, Pottinger PS. Antimicrobial use in patients on a comfort care protocol: a retrospective cohort study. *J Palliat Med.* 2016;19(11):1210-1214.

Background

It is unknown how often patients who are hospitalized at the end of life continue to receive antimicrobials and what factors are associated with antimicrobial use.

Findings

This retrospective cohort study of 1881 hospitalized adults transitioned to a comfort care order (CCO) set at 2 academic medical centers found that 77% of these patients received antimicrobials during their hospital stay (62.4% at 24 hours prior to CCO). Of the 711 still alive at ≥24 hours after CCO, 111 (15.6%) were still on antimicrobials, with that proportion remaining stable for the remainder of hospitalization. In comparing those who did and did not receive antimicrobials after 24 hours of CCO, the presence of a documented infection was not significantly different after adjusting for age. Those with a cancer diagnosis (adjusted risk ratio [ARR] = 1.44: $P = .04$), a longer length of stay (≥7 days vs <7 days; ARR = 1.49; $P = .05$), and those discharged home (ARR 2.93; $P < .001$) or to a facility (ARR 3.63; $P < .001$) versus dying in the hospital were more likely to be on antimicrobials 24 hours after CCO. Compared with those on a medicine service, patients in the medical and surgical intensive care units (ICUs) were less likely to receive antimicrobials (medical ICU ARR = 0.32; $P = .01$; surgical ICU and/or neuro-ICU ARR = 0.32; $P = .02$). The most commonly administered antimicrobials were fluoroquinolones and vancomycin.

Cautions

Only 111 patients were still on antimicrobials at 24 hours, which limited analysis. Investigators relied on retrospective data for medication administration and diagnoses.

Implications

Further work is needed to understand and address the expectations of clinicians, patients, and families regarding the role of antimicrobials at the end of life.

COMMUNICATION AND DECISION MAKING

Video Decision Aids Improved Rates of Advance Care Planning and Hospice Use and Decreased Costs

Volandes, AE, Paasche-Orlow MK, Davis AD et al. Use of video decision aids to promote advance care planning in Hilo, Hawai'i. *J Gen Intern Med.* 2016;31(9):1035-1040.

Background

Advance care planning (ACP) can be enhanced with the use of video decision aids, which may help address scalability and cost.[11] The Hawaii Medical Service Association began an initiative to improve ACP rates, which included a financial incentive. Clinician training and patient access to ACP videos were implemented 1 year into this campaign, which was intended for patients with late-stage disease.

Findings

This study tested the impact of the video intervention on the rates of ACP documentation in Hilo, Hawaii, along with secondary outcomes of hospice use, hospital deaths, and costs. The intervention was sequentially rolled out to Hilo Medical Center (HMC), followed by hospice and primary care practices. Following the video introduction, the proportion of patients discharged from HMC with ACP documentation markedly increased (3.2% to 39.9%; $P < .001$). The percentage of hospital patients discharged to hospice increased from 5.7% to 13.8% ($P < .001$). Overall admissions to the Hospice of Hilo increased at a greater rate than in other parts of Hawaii. After the intervention in Hilo, the in-hospital death rate among patients >65 years old declined slightly ($P = .14$), while in the rest of the state, the rate remained essentially unchanged. ACP planning did not reduce healthcare costs at the end of life, but costs seemed to increase more slowly in Hilo after the intervention than they did in the rest of Hawaii ($P < .05$).

Cautions

This report relies on before-and-after comparisons, with potential confounding by a background pay-for-quality initiative; however, the timing of the changes in outcomes correlates

well with the introduction of the videos. ACP videos have been studied in other settings, so the intervention is likely generalizable to other states.

Implications

A widespread distribution of ACP videos and training for physicians in their use may lead to significant increases in ACP documentation and other beneficial clinical outcomes for patients and health systems.

A Standardized Palliative Care-Led Intervention Did Not Improve Psychological Outcomes in Families of Patients with Chronic Critical Illness

Carson SS, Cox CE, Wallenstein S, et al. Effect of palliative care-led meetings for families of patients with chronic critical illness: a randomized clinical trial. *JAMA*. 2016;316(1):51-62.

Background

Chronic critical illness (CCI) occurs when a patient neither recovers nor dies for days to weeks after an acute illness requiring aggressive intensive care. CCI is associated with poor patient and family outcomes.[12] Does a protocol-driven support and information meeting led by PC providers improve these outcomes?

Findings

This multicenter RCT compared 130 CCI patients (184 surrogates) who received a structured intervention to 126 patients (181 surrogates) with usual care. The structured intervention was led by PC clinicians in order to provide supportive conversations and information about CCI and prognosis compared with the usual intensivist communication. The support and information team met with the families of patients in the intervention group after day 7 of mechanical ventilation (MV) and again 10 days later. Both the intervention and control groups received validated information about CCI, and all were eligible for specialty PC consultation, as indicated. The primary outcome of the study was the Hospital Anxiety and Depression Scale (HADS) at 90-day follow-up with the surrogates. Secondary endpoints included posttraumatic stress disorder (PTSD) assessment and other communication measures as well as patient outcomes (hospital mortality, 90-day survival, length of stay, and days of MV). At least 1 meeting took place for 89% of patients (82% of surrogates) in the intervention arm. Fewer patients in the intervention arm had nonstudy PC consultations (13% vs 22%). Ninety-day HADS results were similar in the 2 groups. PTSD symptoms, however, were higher in the intervention group (Impact of Event Scale-Revised score: 25.9 for intervention and 21.3 for control; intergroup difference 4.6 [95% confidence interval, 0.01-9.10]). There were no statistically significant differences among the patient-focused measures, including survival.

Cautions

Although the teams contained skilled clinicians led by PC practitioners, this was not an ordinary PC intervention. The intervention included information and emotional support meetings alone rather than support from a PC team driven by clinical considerations. This study included surrogates of patients with CCI but not other conditions.

Implications

Protocol-driven support and information meetings may not improve, and may slightly worsen, outcomes in families of patients with CCI. This study did not evaluate and should not be applied to clinically indicated, specialty PC consultation in the ICU.

CAREGIVER OUTCOMES

Caregivers of Patients Surviving Prolonged Critical Illness Experience High and Persistent Rates of Depression

Cameron JI, Chu LM, Matte A, et al. One-year outcomes in caregivers of critically ill patients. *N Engl J Med*. 2016;374(19):1831-1841.

Background

More than half of patients with a CCI require caregiver support 1 year after hospitalization.[13] Caregivers provide tremendous physical and psychosocial support to their loved ones, but that care is often associated with significant burden.[14]

Findings

This prospective parallel cohort study followed caregivers of surviving patients ventilated for at least 7 days from 10 academic hospitals in Canada. The prevalence of depression (Center for Epidemiologic Studies–Depression scale ≥16) in this cohort of 280 caregivers (70% were women) was 67%, 49%, 43%, and 43% at the survey intervals of 7 days, 3 months, 6 months, and 12 months after ICU discharge, respectively. Using latent-class linear mixed models, the investigators identified 2 groups of caregivers: those whose depressive symptoms decreased over time (84%) and those whose depressive symptoms persisted at a high level for the year (16%). Patient characteristics (such as age, comorbidity, sex, and functional status) were not associated with caregiver outcomes. Younger caregiver age, greater effect of patient care on other activities, less social support, less mastery (sense of control), and less personal growth were associated with worse caregiver mental health outcomes.

Cautions

Although this is a high-quality prospective study, causality of caregiving on the high rates of depressive symptoms cannot be confirmed without a control group or knowledge of the caregivers' mental health status prior to the episode of prolonged critical illness.

Implications

Patient critical illness may have serious impacts on caregiver health and well-being. Hospitalists should be attentive to factors associated with caregiver vulnerability and offer support. Improving caregivers' sense of control and social support may be targets for interventions.

People with Non-normative Sexuality or Gender Face Additional Barriers and Stressors with Partner Loss

Bristowe K, Marshall S, Harding R. The bereavement experiences of lesbian, gay, bisexual and/or trans* people who have lost a partner: A systematic review, thematic synthesis and modelling of the literature. *Palliat Med.* 2016;30(8):730-744.

Background

Grief and bereavement impact individuals differently as they adjust to a death. Increasingly, it is recognized that lesbian, gay, bisexual, and/or transgender (LGBT) communities may face additional barriers when interacting with the healthcare system. This review sought to identify and appraise the evidence of the bereavement experiences among LGBT communities.

Findings

This systematic review summarized quantitative and qualitative data from 23 articles (13 studies). The synthesis noted that the pain associated with the loss of a partner was a universal experience regardless of sexual identity or gender history. Additional barriers and stressors of bereavement were reported for LGBT people, including homophobia, failure to acknowledge the relationship, additional legal and financial issues, and the shadow of human immunodeficiency virus (HIV) or acquired immunodeficiency syndrome (AIDS). LGBT people turned to additional resources for bereavement help: professional support, social and familial support, and societal and community support. Caregiver bereavement support experiences were shaped by whether the relationships were disclosed and accepted (acceptance-disclosure model).

Cautions

The quantitative data was mostly from the 1990s and described the context of HIV/AIDS. The qualitative studies, however, were done in the last decade. Very little research was available for transgender or bisexual caregivers.

Implications

People who identify as LGBT face additional barriers and stressors with the loss of a partner. The described acceptance-disclosure model may help providers be mindful of the additional barriers to LGBT bereavement support.

MORAL DISTRESS AND RESILIENCY

Physician Trainees Experience Significant Moral Distress with Futile Treatments

Dzeng E, Colaianni A, Roland M, et al. Moral distress amongst American physician trainees regarding futile treatments at the end of life: a qualitative study. *J Gen Intern Med.* 2016;31(1):93-99.

Background

Physician trainees are often faced with ethical challenges in providing end-of-life care. These ethical challenges can create confusion and conflict about the balance between the benefits and burdens experienced by patients.

Findings

The authors used semistructured, in-depth, qualitative interviews of 22 internal medicine trainees from 3 academic medical centers. An analysis of these interviews revealed several themes. Trainees reported moral distress when (1) many of the treatments provided in end-of-life care (ie, feeding tubes in advanced dementia) were perceived to be futile; (2) they felt obligated to provide end-of-life care that was not in the patient's best interest, leading to "torture" or "suffering" for the patient; (3) they provided care they felt not to be in the patient's best interest; (4) they perceived themselves to be powerless to affect change in these dilemmas; (5) they attributed some of their powerlessness to the hierarchy of their academic institutions; and (6) they feared that dehumanization and cynicism would be required to endure this distress.

Cautions

Resident recruitment occurred by solicitation, which may invite bias. Generalizability of qualitative studies to other settings can be limited.

Implications

Trainees may experience several dimensions of moral distress in end-of-life care. These findings challenge training programs to find ways to reduce the dehumanization, sense of powerlessness, and cynicism that this distress may cause.

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Near and Far

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 previously healthy 30-year-old woman presented to the emergency department with 2 weeks of weakness.

True muscle weakness must be distinguished from the more common causes of asthenia. Many systemic disorders produce fatigue, with resulting functional limitation that is often interpreted by patients as weakness. Initial history should focus on conditions producing fatigue, such as cardiopulmonary disease, anemia, connective tissue disease, depression or cachexia related to malignancy, infection, or other inflammatory states. Careful questioning may reveal evidence of dyspnea, poor exercise tolerance, or joint pain as an alternative to actual loss of muscle power. If true weakness is still suspected, attention should be focused on the pattern, onset, anatomic site, and progression of weakness. Muscle weakness is often characterized by difficulty with specific tasks, such as climbing stairs, rising from a chair, raising a hand, or using cutlery. The physical examination is critical in determining whether weakness is due to true loss of motor power. The differential diagnosis of weakness is broad and includes neurologic, infectious, endocrine, inflammatory, genetic, metabolic, and drug-induced etiologies.

She initially experienced 3 days of mild cramps and soreness in her thighs. She then developed weakness that began in her thighs and progressed to involve her lower legs and upper and lower arms. She had difficulty combing her hair. She required the use of her arms to get up from a chair. She grasped onto objects to aid in ambulation around the house. In addition, she described 1 year of moderate fatigue but no fever, weight loss, dyspnea, dysphagia, visual changes, paresthesias, bowel or bladder incontinence, back pain, or preceding gastrointestinal or respiratory illness. She had experienced diffuse intermittent hives, most prominent in her chest and upper arms, for the past several weeks.

History certainly supports true weakness but will need to be confirmed on examination. The distribution began as proximal but now appears diffuse. The presence of myalgia and cramping raises the possibility of noninflammatory myopathies, which are usually more insidious in onset. A severe electrolyte disturbance would be possible, based on the diffuse nature of weakness that was preceded by cramping. The distribution of weakness and lack of bowel or bladder incontinence is reassuring and suggests against a spinal cord disorder; however, a high index of suspicion must be maintained for myelopathy because delayed treatment might result in irreversible paralysis.

The patient's course also includes hives. Common causes of hives include infections and allergic reactions to medications, foods, and insect stings. Urticaria may also result from systemic disorders, such as vasculitis, lupus, lymphoma, mastocytosis, and paraproteinemias, which can be associated with weakness and fatigue. Although severe weakness in combination with hives makes an infectious and allergic reaction less likely, we still seek to ascertain if the evolving chief complaints of weakness and hives are the result of a single unifying and evolving multisystem disorder or are distinct and unrelated processes.

Her past medical history included fibromyalgia, kidney stones, and gastroesophageal reflux disease. One week prior to presentation, she was prescribed prednisone 60 mg daily for the treatment of hives; the dose had been tapered to 40 mg at presentation, with mild improvement of hives. She recently started doxepin for fibromyalgia and insomnia. She lived at home with her husband and 8-year-old child. She worked as a clerk in a pest control office and denied any pesticide exposure. She denied tobacco, alcohol, or illicit drug use. Her family history included systemic lupus erythematosus (SLE) in her mother and maternal aunt.

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Glucocorticoids are associated with myopathy; however, the weakness preceded steroid therapy. Thus, unless there was unknown exposure to high-dose steroid medication to treat recurrent episodes of urticaria earlier in her course, glucocorticoid-related myopathy is unlikely. Fibromyalgia might cause the perception of weakness from pain. However, the history of difficulty combing her hair and rising from a chair suggests actual loss of motor power. The side effects of her medications, such as newly started doxepin, must be reviewed. A family history of SLE raises concern for rheumatologic conditions; however, one might expect improvement with steroid therapy.

On physical examination, her temperature was 36.9 °C, blood pressure 126/93 mmHg, pulse 81 beats per minute, respiratory rate 16 breaths per minute, and oxygen saturation 100% on ambient air. Her cardiopulmonary examination was normal. Her abdomen was nontender and without hepatosplenomegaly. Her strength was 2 out of 5 in proximal and distal legs, bilaterally, and 4 out of 5 in proximal and distal upper extremities. She had normal muscle tone without fasciculations or atrophy. Her joints were without edema, erythema, or impaired range of motion. She had normal sensation to light touch in arms and legs. Her reflexes were 2+ in the patellar, Achilles, and brachioradialis tendons. She had no lymphadenopathy, mucosal ulcerations, or alopecia. A skin examination revealed smooth, slightly elevated, and faded pink wheals that were diffuse but most prominent in upper arms and chest.

Physical examination confirms the presence of true muscle weakness. The differential diagnosis is narrowed by several findings, both positive and negative, elicited in the examination. The diffuse nature of the weakness eliminates focal central nervous system lesions, such as stroke, intracranial mass lesions, or demyelinating white matter foci. Combining this finding with normal reflexes and history of preceding myalgias makes electrolyte-induced and inflammatory (eg, polymyositis) myopathies more likely. The normal deep tendon reflexes and the absence of a delayed relaxation phase lower the likelihood of hypothyroidism.

Diseases originating from the neuromuscular junction, such as myasthenia gravis, may also present with weakness and normal reflexes, although this pattern of weakness would be atypical; myasthenia gravis classically presents with fatigable weakness and ocular findings of diplopia and/or ptosis. First-tier testing should include a complete blood count to evaluate for eosinophilia, comprehensive metabolic panel, and urinalysis for myoglobinuria, thyroid stimulating hormone, and muscle enzymes.

Results of a complete blood count demonstrated a leukocyte count of 16.1 k/uL with 82% neutrophils, 13% lymphocytes, 5% monocytes, and 0% eosinophils. Hemoglobin was 13.2 g/dL, and platelet count 226 k/uL. Sodium was 136 mmol/L, potassium 1.5 mmol/L, chloride 115 mmol/L, bicarbonate 12 mmol/L, blood urea nitrogen 26 mg/dL, creatinine 1.0 mg/dL (baseline creatinine: 0.6), and glucose 102 mg/dL. Calcium was 9.4 mg/dL, magnesium 2.6 mg/dL, phosphorus 1.8 mg/dL, CK 501 U/L (normal: 40-230), and TSH 5.48 uIU/mL (normal: 0.5-4). Aspartate aminotransferase was 64 U/L, alanine aminotransferase 23 U/L, alkaline phosphatase 66 U/L, bilirubin 0.9 mg/dL, albumin 3.8 g/dL, and total protein 8.7 g/dL (normal: 6.2-7.8). Human immunodeficiency virus antibody screen was negative. An electrocardiogram revealed normal sinus rhythm, flattened T waves, and prominent U waves.

Potassium losses are classically categorized into 1 of 3 groups: renal losses, gastrointestinal losses, or transcellular shifts. Without a clear history of diuretic use, renal losses may not be apparent on history and examination. In contrast, gastrointestinal losses are almost always evidenced by a history of vomiting and/or diarrhea, with rare exceptions, including unreported laxative abuse or surreptitious vomiting. Transcellular potassium shifts can be seen in states of increased insulin or beta-adrenergic activity and alkalosis and result from both primary and secondary causes of hypokalemic periodic paralysis.

The presence of a reduced serum bicarbonate and elevated chloride concentration suggests a normal anion gap metabolic acidosis. Many conditions associated with normal anion gap metabolic acidosis are evident by history, such as diarrhea. In enigmatic cases such as this, it will be important to take a stepwise approach that includes an evaluation for urinary potassium losses and assessment of acid-base status. An unexplained normal anion gap metabolic acidosis combined with hypokalemia raises suspicion for a distal renal tubular acidosis (RTA). Additional testing to evaluate for a possible RTA should include the assessment of urinary electrolytes and urinary pH. The hypokalemia explains her weakness, but the etiology of such profound hypokalemia is not evident, nor is it clear how it relates to her hives.

The severity of the hypokalemia, combined with electrocardiogram changes, necessitates rapid intravenous potassium repletion, telemetry monitoring, and frequent serum potassium measurement. Treatment of her metabolic acidosis is more nuanced and depends upon both the severity of disturbance and the suspicion of whether the etiology is transcellular shift, potassium depletion, or both.

Urine studies demonstrated a urine specific gravity of 1.006 (normal: 1.001-1.030), urine pH was 6.5 (normal: 5-6.5), trace leukocyte esterase, negative nitrite, 30 mg/dL of protein (normal: <15), sodium 64 mmol/L (normal: 40-220), potassium 17 mmol/L (normal: 25-125), and chloride 71 mmol/L (normal: 110-250). Urine microscopy demonstrated 3 red blood cells per high power field (normal: 0-1), 4 white blood cells per high power field (normal: 0-4), 4+ bacteria per high power field, and no red blood cell casts. Urine protein-to-creatinine ratio was 1.6. C3 and C4 complement levels were 53 mg/dL (normal: 80-165) and 12 mg/dL (normal: 15-49), respectively. C-reactive protein was <0.5 (normal: 0-0.9), and erythrocyte sedimentation rate was 16 mm/hour (normal: 0-20).

A calculation of the urine anion gap (UAG; [urine sodium + urine potassium] – urine chloride) yields a UAG of 10 mq/L. A positive UAG, together with a nongap metabolic acidosis, should prompt the consideration of RTA. The normal renal response to acidosis is to reduce the urine pH to less than 5.3 through an increase in hydrogen ion excretion in the form of ammonium. A urine pH of 6.5 is highly suggestive of type 1 (distal) RTA and its associated impairment of distal acidification. Treatment with sodium bicarbonate to correct the acidosis and associated complications is warranted.

A distal RTA would account for her past medical history of renal stones. Acidemia promotes both increased calcium phosphate release from bone (with subsequent hypercalciuria) and enhanced citrate reabsorption in the proximal renal tubules, leading to decreased urinary citrate. Citrate inhibits calcium stone formation. The increased calcium load to renal tubules in addition to decreased urinary citrate both lead to increased precipitation of calcium stones in the genitourinary tract.

A diagnosis of distal RTA should prompt evaluation for specific etiologies, such as Sjögren's syndrome or SLE. While not diagnostic of any specific condition, low C3 and C4 levels suggest immune complex formation with related complement consumption, contributing to hypocomplementemia. The diagnosis of RTA may occur among patients with Sjögren's syndrome in the absence of overt evidence of sicca syndrome (xerostomia and keratoconjunctivitis sicca). Other etiologies of distal RTA include conditions leading to hypercalciuria, such as hyperparathyroidism and idiopathic hypercalciuria, hereditary causes, toxins such as toluene, and drugs such as amphotericin B, lithium carbonate, and ibuprofen.

Her antinuclear antibody titer was >1:1280 (normal: <80). Anti-SSA and -SSB antibodies were both positive, with a titer >100 (normal: <20). Rheumatoid factor was positive at 22 IU/mL (normal: 0-14). Anti-smith, anti-double stranded DNA, and anti-ribonucleoprotein antibodies were negative.

Sjögren's syndrome appears to be the ultimate etiology of this patient's distal RTA. The diagnosis of Sjögren's is more classically made in the presence of lacrimal and/or salivary dysfunction and confirmed with compatible autoantibodies. In the absence of dry eyes or dry mouth, attention should be focused on her skin findings. Cutaneous vasculitis does occur in a small percentage of Sjögren's syndrome cases. Urticarial lesions have been reported in this subset, and skin biopsy would further support the diagnosis.

Treatment of Sjögren's syndrome with immunosuppressive therapy may ameliorate renal parenchymal pathology and improve her profound metabolic disturbances.

On further questioning, she described several months of mild xerostomia, which resulted in increased consumption of fluids. She did not have keratoconjunctivitis sicca. Biopsy of her urticarial rash demonstrated a leukocytoclastic vasculitis with eosinophilic infiltration (Figure 1). Renal biopsy with hematoxylin and eosin staining, immunofluorescence, and electron microscopy demonstrated an immune complex-mediated glomerulonephritis and moderate tubulointerstitial nephritis (Figure 2). A diagnosis of Sjögren's syndrome was made based on the patient's xerostomia, high titers of antinuclear antibodies, SSA and SSB antibodies, positive rheumatoid factor, hypocomplementemia, and systemic manifestations associated with Sjögren's syndrome, including distal RTA, nephrolithiasis, and hives, with histologic evidence of leukocytoclastic vasculitis.

She received aggressive potassium and bicarbonate repletion and, several days later, had normalization of both. Her weakness and myalgia rapidly improved concomitantly with the correction of her hypokalemia. Five days later she was ambulating independently and discharged with potassium

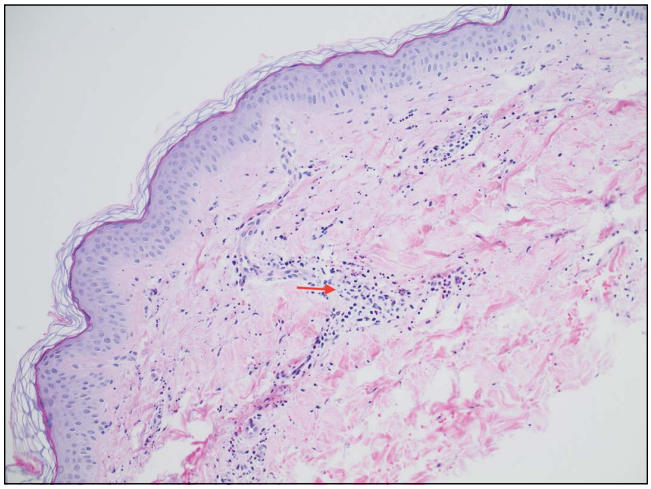

FIG 1. Biopsy specimen of the skin (hematoxylin and eosin, x20). Epidermis and dermis with mixed vascular inflammatory infiltrate, consistent with leukocytoclastic vasculitis.

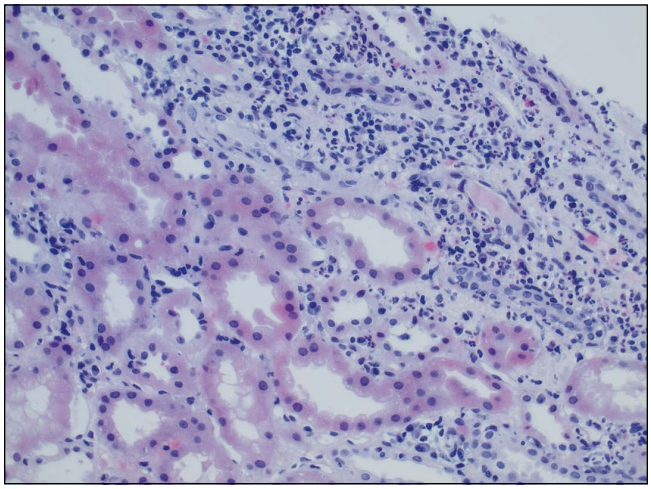

FIG 2. Biopsy specimen of the kidney (hematoxylin and eosin, x40). A mixed interstitial inflammatory infiltrate with lymphocytes, polymorphonuclear neutrophils, and eosinophils is demonstrated, which is consistent with tubulointerstitial nephritis.

citrate and prednisone therapy. She had improved fatigue and rash at a 1-month follow-up with rheumatology. As an outpatient, she was started on azathioprine and slowly tapered off her steroids. Over the next several months, she had normal potassium, bicarbonate, and renal function, although she did require lithotripsy for an obstructive renal stone.

COMMENTARY

RTA should be considered in the differential diagnosis of an unexplained normal anion gap metabolic acidosis. There are 3 major types of RTAs, with different characteristics. In type 1 (distal) RTA, the primary defect is impaired distal acidification of the urine. Distal RTA commonly presents with hypokalemia, calciuria (often presenting as renal stones), and a positive UAG.[1] In type 2 (proximal) RTA, the primary defect is impaired bicarbonate reabsorption, leading to bicarbonate wasting in the urine. Proximal RTAs can be secondary to an isolated defect in bicarbonate reabsorption or generalized proximal renal tubule dysfunction (Fanconi syndrome).[1] A type 4 RTA is characterized by hypoaldosteronism, presenting usually with a mild nonanion gap metabolic acidosis and hyperkalemia. This patient's history of renal stones, hypokalemia, and positive UAG supported a type 1 (distal) RTA. Distal RTA is often idiopathic, but initial evaluation should include a review of medications and investigation into an underlying systemic disorder (eg, plasma cell dyscrasia or autoimmune disease). This would include eliciting a possible history of xerostomia and xerophthalmia, together with testing of SSA (Ro) and SSB (La) antibodies, to assess for Sjögren's syndrome. In addition, checking serum calcium to assess for hyperparathyroidism or familial idiopathic hypercalciuria and a review of medications, such as lithium and amphotericin,[1] may uncover other secondary causes of distal RTA.

While Sjögren's syndrome primarily affects salivary and lacrimal glands, leading to dry mouth and dry eyes, respectively, extraglandular manifestations are common, with fatigue and arthralgia occurring in half of patients. Extra-glandular involvement also often includes the skin and kidneys but can affect several other organ systems, including the central nervous system, heart, lungs, bone marrow, and lymph nodes.[2]

There are many cutaneous manifestations of Sjögren's syndrome.[3] Xerosis, or xeroderma, is the most common and is characterized by dry, scaly skin. Cutaneous vasculitis can occur in 10% of patients with Sjögren's syndrome and often presents with palpable purpura or diffuse urticarial lesions, as in our patient.[4] Erythematous maculopapules and cryoglobulinemic vasculitis may also occur.[4] A less common skin manifestation is annular erythema, presenting as an indurated, ring-like lesion.[5]

Chronic tubulointerstitial nephritis is the most common renal manifestation of Sjögren's syndrome.[6] This often pre-sents with a mild elevated serum creatinine and a distal RTA, leading to hypokalemia, as in the case discussed. Distal RTA is well described, occurring in one-quarter of patients with Sjögren's syndrome.[7] The pathophysiology leading to distal RTA in Sjögren's syndrome is thought to arise from autoimmune injury to the H(+)-ATPase pump in the renal collecting tubules, leading to decreased distal proton secretion.[8,9] Younger adults with Sjögren's syndrome, in the third and fourth decades of life, have a predilection to develop tubulointerstitial inflammation, distal RTA, and nephrolithiasis, as in the present case.[6] Sjögren's syndrome less commonly presents with membranoproliferative glomerulonephritis or membranous nephropathy.[10,11] Cryoglobulinemia-associated hypocomplementemia and glomerulonephritis may also occur with Sjögren's syndrome, yet glomerular lesions are less common than is tubulointerstitial inflammation. The patient discussed had proteinuria and evidence of immune complex-mediated glomerulonephritis.

Treatment of sicca symptoms is generally supportive. It includes artificial tears, encouragement of good hydration, salivary stimulants, and maintaining good oral hygiene. Pilocarpine, a cholinergic parasympathomimetic agent, is approved by the Food and Drug Administration to treat dry mouth associated with Sjögren's syndrome. The treatment of extraglandular manifestations depends on the organ(s) involved. More severe presentations, such as vasculitis and glomerulonephritis, often require immunosuppressive therapy with systemic glucocorticoids, cyclophosphamide, azathioprine, or other immunosuppressive agents,[12] including rituximab. RTA often necessitates treatment with oral bicarbonate and supplemental potassium repletion.

The base rate of disease (ie, prevalence of disease) influences a diagnostician's pretest probability of a given diagnosis. The discussant briefly considered rare causes of hives (eg, vasculitis) but appropriately fine-tuned their differential for the patient's hypokalemia and RTA. Once the diagnosis of Sjögren's syndrome was made with certainty, the clinician was able to revisit the patient's rash with a new lens. Urticarial vasculitis suddenly became a plausible consideration, despite its rarity (compared to allergic causes of hives) because of the direct link to the underlying autoimmune condition, which affected both the proximal muscles and distal nephrons.

TEACHING POINTS

- Evaluation of patients with weakness starts with determining true muscle weakness (ie, pathology involving the brain, spinal cord, peripheral nerve, neuromuscular junction, and/or muscle) from asthenia.
- Distal RTA should be considered in patients with a nonanion gap metabolic acidosis and hypokalemia.
- Sjögren's syndrome has many extraglandular clinical manifestations, including vasculitis, urticaria, tubulointerstitial renal inflammation, glomerulonephritis, and lymphoma.

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Faculty Development for Hospitalists: A Call to Arms

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Over the past two decades, the field of hospital medicine has gone from relative obscurity to a viable career pathway for approximately 50,000 physicians in this country.[1] A subset of hospitalists pursue careers in academic medicine, which is a pathway that traditionally includes education and scholarship in addition to patient care. While the academic career pathway is well paved in many clinical specialties, it is still relatively underdeveloped for academic hospitalists, and thus what defines career success for this group is even less clear.

In this issue of the *Journal of Hospital Medicine*, Cumbler et al. performed a qualitative analysis to explore how early career academic hospitalists self-define and perceive their career success.[2] Drawing on interviews with 17 early-career hospitalists at 3 academic medical centers, the authors created a theoretical framework organized around a traditional conceptual model of career success that is divided into intrinsic and extrinsic motivating factors. They found that early-career academic hospitalists, (clinician-educators in first 2-5 years), defined their career success almost exclusively around factors intrinsic to their day-to-day job. These factors included such things as excitement about their daily work, developing proficiency in the delivery of high-quality clinical care, and passion for doing work that is meaningful to them. In addition to these immediate job satisfiers, many hospitalists emphasized long-term career success factors such as becoming an expert in a particular domain of hospital medicine and gaining respect and recognition within their local or national environment. Surprisingly, compensation and career advancement through promotion, two traditional external career success factors, were not uniformly valued.

These findings come at a critical time for our field in which early-career faculty outnumber mid- and late-career faculty by an order of magnitude. Indeed, how to develop, promote, sustain, and retain young hospitalists is a topic on the minds of most hospital medicine group directors. Putting aside the impact of hospitalist turnover on productivity, patient care outcomes, and morale within an individual hospital medicine group, we agree with the authors that understanding and cultivating career success for academic hospitalists is imperative for the future of our field. For this reason, we launched a formal faculty development program at Penn this year, which focuses on supporting the growth of hospitalists in their first two years on faculty. The findings of this study provide interesting new perspectives and encourage us to continue our focus on early-career academic hospitalists. We laud the previous efforts in this area and hope that the paper by Cumbler et al. encourages and inspires other programs to start or accelerate their hospitalist faculty development efforts.[3-5]

However, some findings from this study are somewhat perplexing or even a bit discouraging for those who are invested in faculty development in academia. For example, the authors raise the possibility that there may be a disconnect in the minds of early-career hospitalists as it pertains to their thoughts on career success. On the one hand, the hospitalists interviewed in this study are happy doing their clinical work and cite this as a primary driver of their career success. On the other hand, they equate career success with things such as developing expertise within a particular domain of hospital medicine, acquiring leadership roles, collaborating academically with other specialties or professions, or developing new innovations. Presumably this is part of the reason that they selected a job in an academic setting as opposed to a community setting. However, in order to achieve these goals, one must devote time and effort to purposefully developing them. Therefore, identifying and developing mentors who can assist early-career hospitalists with identifying, articulating, and developing strategies to achieve both their short- and long-term career goals is critical. One mentor–mentee conversation may reveal that an individual hospitalist values being an excellent clinician and has little interest in developing a niche within hospital medicine; another may reveal a lack of awareness of available professional development resources; still another may uncover a lack of realism regarding the time or skills it takes to achieve a particular career goal. These realities highlight an imperative for our field to develop robust and sustainable mentorship programs for not only early-career hospitalists but also some mid-career hospitalists whose careers may not yet be fully developed. Indeed, one of the biggest challenges that have emerged in our experience with a faculty development program at Penn is creating meaningful mentorship and career development advice for mid-career hospitalists (late assistant or early associate professors who are typically 5-10 years into their careers).

We found it interesting that the hospitalists interviewed did not mention three of the four pillars of career satisfaction outlined in the white paper on Hospitalist Career Satisfaction

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from the Society for Hospital Medicine: workload schedule, autonomy control, and community/environment.[6] Perhaps this is because hospitalists, like many other professionals, recognize that feeling satisfied in one's career is not the same as feeling successful. Satisfaction in one's career refers to the foundational needs that one requires in order to feel content, whereas success is more often equated with achievement, even if that achievement is simply the acquisition of one's goals for themselves. The reality is that given the constant growth and change within teaching hospitals, and therefore academic hospital medicine groups, tending to the satisfiers for hospitalists (eg, schedule and workload) often takes a front seat to assisting faculty in achieving their individual career potential. We assert that despite the inherent difficulty, academic hospital medicine group leaders need to focus their attention on both the satisfaction and career success of their early-career faculty.

Finally, this paper raises many interesting questions for researchers interested in the professional development of hospitalists. Are the career success perspectives of an early-career academic hospitalist different from those of an early-career intensivist or emergency medicine physician in an academic setting? Hospital medicine has historically been likened to both fields given the similar intensity of clinical work and the fact that all three fields were created around the need for specialists in a care setting as opposed to a disease state. It is possible that the vision of success for young academic physicians as a whole has changed with the millennial generation entering the workforce. Do early-career hospitalists look different from early-career general internists in academic settings? The latter group has more promoted faculty in their division to serve as role models and mentors and who have demonstrated more success in a variety of replicable career pathways. The fact that the definition of career success may evolve over time also emerged as a theme from this paper. Do mid-career academic hospitalists find that the excitement for daily clinical work wanes over time leaving them feeling less successful and looking for something more?

In conclusion, the findings of Cumbler et al. should promote unrest among leaders of academic hospital medicine groups and their departments of medicine. While it is inspiring to see so many early-career hospitalists focused on their daily happiness at work, we are unsure about whether they have the knowledge, tools, and guidance to achieve their self-professed academic goals, which many equate with career success. Given the continued growth of the hospital medicine workforce, we view this important new work as a national call to arms for the purposeful development of academic hospitalist faculty development programs.

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Continuous Physiologic Monitoring: False Alarms and Overdiagnosis

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What is the most common intervention to which hospitalized children are exposed? Acetaminophen? IV access? Phlebotomy? Or is it being connected to a monitor?

In a study conducted in five children's hospitals, Schondelmeyer et al found that exposure to continuous electronic physiologic monitoring was extremely common. During a selected 24-hour window of observation, nearly 100% of PICU and NICU patients and 26%-48% of medical–surgical patients were exposed to continuous monitoring.[1] The latter is undoubtedly an underestimate given that monitoring periods less than 24 hours were not captured, patients may have been exposed before or after the 24-hour study window, and monitoring in the emergency department was not included.

The omnipresence of electronic physiologic monitoring in children's hospitals is striking, particularly because we know very little about its benefits. Outside of the perioperative period, there is a dearth of evidence demonstrating improved outcomes for hospitalized children as a result of continuous physiologic monitoring. Guidelines for the most common inpatient pediatric conditions do not advocate for continuous physiologic monitoring. Presumably, this practice has become so pervasive in the absence of a strong evidence base and guideline recommendations because it is a passive, seemingly innocuous intervention that continuously collects important components of the physical examination (after all, they are known as "vital" signs). It is tempting to assume that providing clinicians with this information will make patients safer.

The danger of routinely exposing children to an intervention for which the benefits are unproven is that the net effect of the intervention may be harm. What could be harmful? The simple act of monitoring is distressing to children; sticky electrode pads stuck to their skin and a tangle of wires that restrict their movement–all impeding physical activity and contact with loved ones.

Then, there are the alarms. Schondelmeyer et al report a staggering number of them: between 42 and 152 alarms per monitored day on the floor; between 54 and 351 alarms in the intensive care units. The vast majority are false alarms, triggered by inappropriate preselected thresholds or displaced leads. This cacophony of noise only amplifies an already stressful environment for our patients–and their parents. Nurses and physicians are similarly stressed by alarms, not only by the noise but also by the frequent need to respond to them. The combination of frequent and largely unnecessary interruptions leads to alarm fatigue, whereby providers are desensitized to the alarms and may be slower to recognize a truly decompensating patient.

Continuous monitoring also risks overdiagnosis, the accurate detection of abnormalities that are not destined to cause problems, but nonetheless trigger interventions that can cause harm.[2] Studies in adult populations have demonstrated that continuous monitoring can produce overdiagnosis. Repeated Cochrane reviews conclude that continuous electronic fetal monitoring during labor is associated with overdiagnosis of fetal distress—with attendant increase in cesarean sections without decreasing the risk for important neonatal outcomes such as cerebral palsy and mortality.[3] A recent randomized trial of continuous pulmonary impedance monitoring intended to reduce readmission rates in patients with CHF instead found that continuous monitoring resulted in overdiagnosis of CHF exacerbations—paradoxically increasing hospital admission with no significant change in mortality (in fact, mortality was nominally higher in the monitoring group).[4]

Pediatric providers are probably no less susceptible to the impulse to act in the face of abnormalities detected by continuous monitoring. EKGs and electrolyte panels may be ordered in response to transient arrhythmias. Similarly, it is challenging for providers to watch a monitor flashing elevated respiratory rates in an otherwise healthy infant with bronchiolitis and not seek an escalation in care, including increased oxygen flow or transfer to a higher acuity unit. Although arrhythmia and respiratory rate alarms were common in Schondelmeyer et al's study, low oxygen level was far and away the most common alarm. Indeed, the poster child of pediatric overdiagnosis in the setting of electronic physiologic monitoring is hypoxemia. The present body of literature suggests that overreliance on pulse oximetry among patients with bronchiolitis increases admission rates to the hospital and prolongs length of stay, without a measurable improvement in morbidity or mortality.[5]

Few patients cared for at American children's hospitals will be discharged without exposure to prolonged periods of continuous physiologic monitoring. Undoubtedly, there are inpa-

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tients who benefit from this technology, such as children on mechanical ventilators. Unfortunately, there are also patients who are undoubtedly harmed by it. Greater understanding of which types of patients are more likely to benefit and which are more likely to be harmed is needed to determine whether continuous physiologic monitoring should remain our most common hospital intervention.

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Is it Time to Re-Examine the Physical Exam?

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"Am I supposed to have such a hard time feeling the kidneys?" "I think I'm doing it wrong," echoed another classmate. The frustration of these first-year students, who were already overwhelmed by the three pages of physical exam techniques that they were responsible for, became increasingly visible as they palpated the abdomens of their standardized patients. Then, they asked the dreaded question: "How often do you do this on real patients?"

When we teach first-year medical students the physical exam, these students are already aware that they have never observed physicians perform these maneuvers in their own medical care. "How come I've never seen my doctor do this before?" is a common question that we are often asked. We as faculty struggle with demonstrating and defending techniques that we hardly ever use given their variable utility in daily clinical practice. However, students are told that they must be familiar with the various "tools" in the repertoire, and they are led to believe that these skills will be a fundamental part of their future practice as physicians. Of course, when they begin their clerkships, the truth is revealed: the currency on the wards revolves around the computer. The experienced and passionate clinicians who may astonish them with the bedside exam are the exception and are hardly the rule.

In this issue of *Journal of Hospital Medicine*, Bergl et al.[1] found that when medical students rotated on their internal medicine clerkship, patients were rarely examined during attending rounds and were even examined less often when these rounds were not at the bedside. Although the students themselves consistently incorporated the physical exam into patient assessments and presentations, neither their findings nor those of the residents were ever validated by the attending physician or by others. Notably, the physical exam did not influence clinical decision making as much as one might expect.

These findings should not come as a surprise. The current generation of residents and junior attendings today are more accustomed to emphasizing labs, imaging studies, pathology reports, and other data within the electronic health record (EHR) and with formulating initial plans before having met the patient.[2] Physicians become uneasy when asked to decide without the reassurance of daily lab results, as if the information in the EHR is highly fundamental to patient care. Caring for the "iPatient" often trumps revisiting and reexamining the real patient.[3] Medical teams are also bombarded with increasing demands for their attention and time and are pushed to expedite patient discharges while constantly responding to documentation queries in the EHR. Emphasis on patient throughput, quality metrics, and multidisciplinary communication is essential to provide effective patient care but often feels at odds with opportunities for bedside teaching.

Although discussions on these obstacles have increased in recent years, time-motion studies spanning decades and even preceding the duty-hours era have consistently shown that physicians reserve little time for physical examination and direct patient care.[4] In other words, the challenges in bringing physicians to the bedside might have less to do with environmental barriers than we think.

Much of what we teach about physical diagnosis is imperfect,[5] and the routine annual exam might well be eliminated given its low yield.[6] Nevertheless, we cannot discount the importance of the physical exam in fostering the bond between the patient and the healthcare provider, particularly in patients with acute illnesses, and in making the interaction meaningful to the practitioner.

Many of us can easily recall embarrassing examples of obvious physical exam findings that were critical and overlooked with consequences – the missed incarcerated hernia in a patient labeled with gastritis and vomiting, or the patient with chest pain who had to undergo catheterization because the shingles rash was missed. The confidence in normal findings that might save a patient from unnecessary lab tests, imaging, or consultation is often not discussed. The burden is on us to retire maneuvers that have outlived their usefulness and to demonstrate to students the hazards and consequences of poor examination skills. We must also further what we know and understand about the physical exam as Osler, Laennec, and others before us once did. Point-of-care ultrasound is only one example of how innovation can bring trainees to the bedside, excite learners, engage patients, and affect care in a meaningful way while enhancing the nonultrasound-based skills of practitioners.[7]

It is promising that the students in this study consistently examined their patients each day. As future physicians, they can be very enthusiastic learners eager to apply the physical exam skills they have recently acquired during their early years of training. However, this excitement can taper off if not actively encouraged and reinforced, especially if role models are unintentionally sending the message that the physical exam does not matter or emphasizing exam maneuvers that do not serve a meaningful purpose. New technology will hopefully help us develop novel exam skills. If we can advance what we

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can diagnose at the bedside, students will remain motivated to improve and learn exam skills that truly affect patient-care decisions. After all, one day, they too will serve as role models for the next generation of physicians and hopefully will be the ones taking care of us at the bedside.

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Inpatient Portals: The Questions that Remain

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Personal health records (PHRs) are a broad group of applications "through which individuals can access, manage, and share their health information," and are intended as a means to increase consumer health awareness, activation, safety, and self-efficacy.[1] Patient portals—PHRs that are tethered to an electronic health record (EHR)—have expanded over the past decade, driven in part by the "Meaningful Use" EHR Incentive Program of the Centers for Medicare and Medicaid Services.[2] This has been particularly true in the outpatient setting. Unfortunately, despite increased adoption and a large number of research studies, it is not clear whether outpatient portal use is associated with improved clinical outcomes.[3]

Both the use of portals in the inpatient setting and the research thereof are at a more nascent stage. In this issue of the *Journal of Hospital Medicine*, Kelly et al.[4] provide a systematic review of the existing research on the implementation of inpatient portals. The authors identified 17 studies and categorized the papers' findings into the following 3 themes: design, use and usability, and impact. Most of the studies elicited feedback from patients, caregivers, and/or providers – sometimes in multiple phases as portals were redesigned – allowing the authors to offer the following recommendations for inpatient portal design: portals should present timely information, include the care plan in ways patients can understand, and facilitate identification and communication with the care team.[4] Most of the included studies focused on portal design and use, thereby limiting knowledge regarding impact on the outcomes portals are intended to target. All findings should be interpreted with caution, as many of the included studies were small and qualitative, most of them used convenience samples and subject-reported outcomes, and all were conducted at a single center. Many sites also used customized portals, thus limiting generalizability.

Participants often found portals to be useful, but this finding is of uncertain value in the absence of robust evidence on outcomes. In addition, providers included in the reviewed studies expressed concerns that have not yet been well studied, such as the potential impact of portals on workload and on patient anxiety. Some studies reported that provider concerns lessened following a portal rollout, but few studies evaluated physician input on features such as direct communication and test result reporting in active use. The outpatient portal literature suggests potential harm related to how results are delivered, thus placing importance on conducting additional inpatient studies. Patients value online access to their health information[5] and in previous literature have indicated a preference for immediate access to results even if abnormal results would then be given without explanation.[6] However, in a recent study, even normal findings delivered without context were a cause of negative emotions and increased calls to physicians.[7] This effect could be more pronounced in inpatient settings, given the large volume of tests and abnormal results, the rapidly evolving treatment plans, and generally higher acuity and medical uncertainty.

This review and other current literature highlight challenges for vendors and hospitals. Vendors must ensure that patient health information is contextualized and delivered in a manner that meets individual learning styles.[8] Patients and caregivers need clinical decision support to process today's large amount of data, just as providers do. We must be careful not to implement patient portals in ways that increase cognitive load and generate anxiety and confusion. Hospitals have infrastructural challenges if portals are to be successful. Care provider information must be accurately registered in the EHR to route patient-to-provider communications, a difficult task across frequent handoffs and staffing changes.

We now have the beginnings of an informed vision for inpatient portal design. Future research and industry directions include greater exploration of recognized concerns and how to best reconcile these concerns with the benefits of portals espoused by consumer health advocates and experienced by patients, caregivers, and providers in the reviewed studies. Specifically, we need a better understanding of how best to incorporate inpatient portals into routine care delivery in ways that are useful to both patients and providers. We also need a better understanding of why patients opt out of portal use. Most of the studies to date report on the set of patients who decided to use the portals, leaving a knowledge gap in design and use implications for patients who opted out. Studies should include comparisons of patient outcomes between users and nonusers. Although inpatient portals show promise, many questions remain.

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In Reference to "The Weekend Effect in Hospitalized Patients: A Meta-Analysis"

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The prevalent reason offered for increased mortality rates during weekend hours are shortages in staffing and services. The "weekend effect," elucidated by Pauls et al.[1] in their recent meta-analysis, and the accompanying editorial by Quinn and Bell,[2] highlight these and other potential causes for this anomaly.

Pauls et al.[1] also cite patient selection bias as a possible explanation for the uptick in deaths during this span (off-hour admissions may be sicker). It is due to the latter that we wish to highlight additional studies published after mid-2013 when the authors concluded their search.

Recent disputes within the UK's National Health Service[3] concerning health system funding spurred timely papers in *BMJ*[4] and *Lancet*[5] on the uncertainty. They both discovered a stronger signal from patient characteristics admitted during this time rather than on-hand resources and workforce. These new investigations strengthen the support for patient acuity as a determinant in explaining worse outcomes.

We highlight these manuscripts so investigators will continue their attempts to understand the weekend phenomena as suggested by both Pauls et al.[1] and the editorialists.[2] To allow for the delivery of correct interventions, we must understand its root causes. In this case, it may be the unique features of patients presenting on Saturdays and Sundays and, hence, would require a different set of process changes.

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The Authors Reply, "The Weekend Effect in Hospitalized Patients"

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We would like to thank Drs. Flansbaum and Sheehy for their interest in our article.[1] We appreciate their mentioning the highly publicized disputes and additional manuscripts[2,3] that were published after our literature review, which was conducted in 2013.

As discussed by Drs. Flansbaum and Sheehy and the editorial accompanying our article,[4] the precise contributions, if any, of various potential factors (eg, patient characteristics, resources, workforce) to the development of the weekend effect is uncertain at this time; although, as mentioned by Drs. Flansbaum and Sheehy, more recent work[2,3] suggests that patient characteristics may be a more important determinant on outcomes.

Despite the uncertainty surrounding the exact composition and contributions of various elements to the weekend effect, it does appear to be a real phenomenon, as noted by the editorialists.[4] We hope that our manuscript encourages future investigators to help elucidate the nature of the input contributing to the weekend effect.

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