

# An Electronic Communication Workflow Optimization for Inpatient Specialist Consultation at an Academic Health Care System

Maiah Zarrabi<sup>1\*</sup> Leesa Li-Fossum<sup>1\*</sup> Betty Tseng<sup>2</sup> Kelly Lockett<sup>2</sup> Arash Shamsian<sup>2</sup> Myung Shin Sim<sup>3</sup>  
Daniel M. Kozman<sup>3\*\*</sup> Mindy K. Ross<sup>1\*\*</sup>

<sup>1</sup> Department of Pediatrics, David Geffen School of Medicine at the University of California Los Angeles, Los Angeles, California, United States

<sup>2</sup> Information Services and Solutions, University of California Los Angeles, Los Angeles, California, United States

<sup>3</sup> Department of Medicine, David Geffen School of Medicine at the University of California Los Angeles, Los Angeles, California, United States

**Address for correspondence** Mindy K. Ross, MD, David Geffen School of Medicine at the University of California Los Angeles, 10833 Le Conte Avenue MDCC 22-387B, Los Angeles, CA 90095, United States (e-mail: mross@mednet.ucla.edu).

Appl Clin Inform 2022;13:677–680.

## Background and Significance

Specialist team consultation is a mainstay of modern medical practice due to the increased complexity of inpatient medicine. Timely consultation can be crucial to patient assessment and treatment plans<sup>1</sup>; however, delayed consultation can occur due to communication barriers.<sup>2</sup> Communication for specialist consultation in the inpatient setting is often dependent upon the use of hospital phone operators, pager devices, and web-based systems that are separate from the electronic health record (EHR).<sup>3</sup> Given the growing amount of multidisciplinary care, limited human resources, and time constraints, it is advantageous to eliminate inefficiencies in communication wherever possible.

The adoption of inpatient technology-based EHR solutions for inpatient communication has been explored to address these inefficiencies.<sup>4</sup> Weigert et al demonstrated that a web-paging system standardized with required fields improved user satisfaction.<sup>5</sup> Other efforts have demonstrated potential for decreased errors, including permanent team pager numbers, care team identification, and messaging platforms.<sup>6–9</sup> One system to contact consultants directly improved team communication,<sup>10</sup> though there is still need for further research to determine the most effective method for consulting specialists, and what

the impact would be on time to consult by directly reaching consultants through the EHR.

## Objectives

To streamline the inpatient consultation process, we designed and implemented a one-step method to directly page consultants through an order placed in the EHR. We hypothesized this intervention would decrease time to specialist consultation and improve end-user satisfaction.

## Methods

### Setting

We tested the direct paging order for consults to inpatient pediatric pulmonology over a 4-month period in the University of California, Los Angeles (UCLA) Health System, which is a quaternary academic medical center. There are no trainees on this consult service, so attendings receive pages directly. The EHR is Epic Systems and the communication paging system is Spok Mobile. At our medical center, pediatric resident physicians are typically responsible for sending consult pages, though attending hospitalists, other specialists including fellows, and nurse practitioners may also be responsible for ordering and paging consultants at times. Prior to the intervention, the standard pediatric specialist consultation workflow was for the consult requester to (1) place the consult order in the EHR (optional step) and then (2) page the consultant by either calling the hospital operator to look up the on-call

\* *Co-first authors.*  
Co-senior authors.

received  
January 31, 2022  
accepted after revision  
May 5, 2022

© 2022. Thieme. All rights reserved.  
Georg Thieme Verlag KG,  
Rüdigerstraße 14,  
70469 Stuttgart, Germany

DOI <https://doi.org/10.1055/s-0042-1750356>.  
ISSN 1869-0327.

consultant and send a verbally dictated page or looking up the on-call consultant via a web-based paging system and free texting the relevant patient information, reason for consult, and call-back contact information. A waiver of consent was obtained through the UCLA Institutional Review Board for this work.

### Intervention

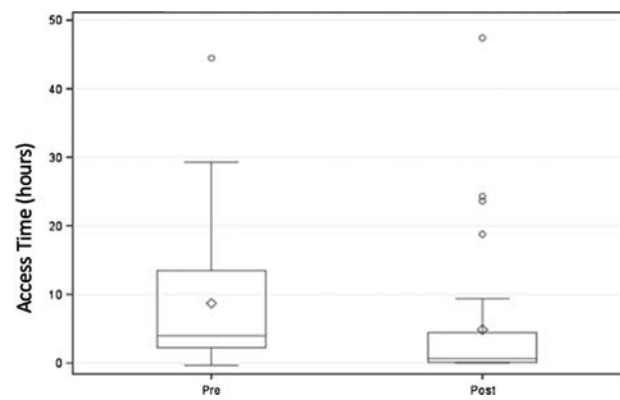
The functionality of the EHR consult order for pediatric pulmonology was re-designed to allow a direct page to be sent to the consultant through an assigned “virtual pager” number (i.e., a pager number used by the division that is the same regardless of which individual is on-call; this number is programmatically assigned to the on-call consultant’s personal pager number). The page could be sent immediately or the following morning at 0800. Discrete fields to enter necessary information were included, such as call-back number and reason for consult. The ordering user’s name, patient’s surname, medical record number, age, and gender were automatically included in the page. A tip-sheet with instructions about how to use the system was created and e-mailed to the pediatric residents about the new paging workflow for pediatric pulmonology consultation and the consultants were verbally informed that the paging order functionality was being modified to send a page directly when the order was placed. The Spok paging system also sends an e-mail with every page as a safeguard, but there was no further enhancement in the EHR at this stage, such as an automatic patient consult list or in-basket message generated for the consultants based on the page.

### Measurement

To quantitatively reflect the intervention’s effect on time to consultation, we measured the following: the time a consult order was placed, the time the consultant entered the chart, and the time the note was filed. We measured the time the consultant entered the chart because often recommendations will be provided verbally prior to finalization of the clinical note. The concept of the direct paging order is that it potentially allows the requestor to alert the consultant sooner in the day about the consult since a page with the consult information can be sent when the order is placed, rather than later when the requestor found time to determine the proper person on-call and page them. Cases in which the order was placed after the consultant entered the chart were excluded. Data collected 2 months postimplementation were compared with data collected 2 months prior to implementation. Samples were independent with different consultants and patient consults; therefore, an unpaired two-sample Wilcoxon rank sum test was used. We compared dichotomized hours to filing using the Chi-square test. We also performed pre- and post-qualitative Likert-scale surveys of resident satisfaction with the paging system workflow.

### Results

Over the 2-month period, there were 23 consult orders placed pre- and 32 postintervention that met inclusion



**Fig. 1** Time (in hours) for the consultant to access the patient chart before and after the direct paging intervention.

criteria for our quantitative analysis. Eleven consult orders were placed after the consultant accessed the chart, and consults requested without a formal consult order placed were not tracked. The time for the consultants to access the patient chart following placement of consultation order decreased from a median of 4.03 hours (interquartile range [IQR]: 2.39–14.17) preintervention to 0.63 hours (IQR: 0.09–4.44) postintervention ( $p = 0.001$ ; —Fig. 1). The time for consultants to file their note following placement of consultation postintervention decreased from a median of 26.88 hours (IQR: 15.40–32.47) to 13.84 hours (IQR: 6.34–32.05) postintervention ( $p = 0.159$ ), but did not reach statistical significance. Comparisons between pre- and postintervention using Chi-square testing showed that charts were accessed more within an hour after the order was placed (17.39% pre- vs. 65.63% postintervention;  $p = 0.004$ ) and charts were filed significantly more often by 9 hours after consult order was placed (13.04% pre- vs. 37.5% post;  $p = 0.045$ ).

Sixteen of the 29 residents (55%) who paged consultants with the new paging order completed a pre- and postimplementation survey. Prior to the intervention, no residents who replied to the survey ( $n = 56$ ) were “very satisfied,” and 64% were “dissatisfied” or “very dissatisfied” with the current paging system and workflow. After the implementation, 81% of residents who placed a consult order and completed the postintervention survey reported that they were “very satisfied” with the new consultation paging process, with no dissatisfied responses.

### Discussion

In our pilot study, the new one-step pediatric pulmonology consult order with direct consultant paging significantly reduced the median time for pediatric pulmonologists to access the chart after a consult order was placed from hours to minutes, and decreased the time to file their note by nearly half the preintervention time. The pediatric residents who used the new paging system were more satisfied with the consult order and paging workflow.

Timeliness of specialist consultation is an important factor in a high-quality inpatient consultation, in part because

otherwise there is the potential to delay care and discharges.<sup>11,12</sup> Efforts to decrease time to consultation should address multiple contributing factors, some easier to address than others. For example, institutional communication system and coordination of care inefficiencies may be more difficult to effect change upon. However, the EHR may serve to alter entrenched workflows more quickly as in our case of implementing the one-step paging order process.

This intervention also increased satisfaction for the end-users placing the consult, per their report, because it saved them time, was efficient, and standardized the consultation process. Transition from paper to electronic charts in past decades has important benefits but also comes with many other consequences including increased documentation workload, general inefficiencies, care coordination challenges, and contribution to physician burnout.<sup>13</sup> Overall, shortening tasks for end-users and improving multidisciplinary communication, which our project addresses, are valuable strategies to potentially improve end-user quality of life and enhance patient care.<sup>14,15</sup> Based on our pilot findings, we are expanding this direct-paging system across pediatric subspecialties at our institution. We are also expanding our qualitative analysis to include consultants to further evaluate ways to optimize inpatient communication on both sides of consultation.

Our work has strengths but also limitations, including a small sample size for both quantitative and qualitative analyses. Because placing a consult order was not required, many consults occurred but not included in this analysis. We anticipate that with a higher powered analysis, the median time to note file time would be significantly decreased. However, this might not be the case because of systemic inefficiencies among other factors, as physicians often have to chart after-hours.<sup>13,16</sup> The time of day the page is sent may also impact response time and we plan to explore that aspect more in the future. In addition, the pediatric pulmonologists were aware the consult order functionality had changed, and this may have affected behavior of responding to consult requests. In addition, many pediatric residents were unfamiliar with placing the consult order itself, but over time, this is anticipated to change especially as formal training is provided and “word-of-mouth” about the direct paging capability of the order spreads. We plan to measure the frequency of consult order placement in future expansions of this work. There is also the potential to further enhance the system by automatically adding patients to a shared consult list and/or in-basket notification if that is desired by the consultant service. We did not measure communication or other errors pre- and postintervention and time to consultation was a proxy for clinical benefit. Additionally, residents who completed surveys may be different from those who did not. Residents may have had a favorable response bias knowing that physicians with whom they worked were designing this new system. Finally, this pilot was performed within only one group in an academic health care system, and while this was a sample of convenience limited to one pediatric subspecialty with attendings receiving consultations directly, we anticipate this will translate to other users,

pediatric subspecialties, and fields based on continued favorable feedback from end-users. Of note, staffs of multiple adult services at our institution who became aware of our work have since requested and leveraged this new functionality, and have provided our authors with highly positive feedback about their new workflows. We are currently expanding the functionality to other services, including pediatric surgery.

## Conclusion

The one-step, direct paging of consultants through an order placed in the EHR more often contributed to an earlier note file time and decreased consultant time to access the chart after the consult was ordered. This workflow will be expanded to more services at our institution and measured. In complex health systems, efficient multidisciplinary care coordination may be enhanced by the optimization of workflows through integration of health care information and communication technologies.

## Clinical Relevance Statement

This work is a novel description in the literature of a communication workflow enhancement directly performed through the EHR for inpatient pediatric specialty consultation. This intervention has potential to not only improve patient care but also enhance end-user satisfaction with the EHR.

## Multiple Choice Questions

1. Who is considered a project stakeholder?
  - a. Patients.
  - b. Consultants.
  - c. Providers.
  - d. All of the above.

**Correct Answer:** The correct answer is option d, all of the above (Clinical Informatics Study Guide, Finnell and Dixon). Project stakeholders are defined by anyone who is impacted by the project. Project managers and tool designers ideally will take all stakeholders into consideration. It also highlights that projects reach many different people and be considered high impact; however, there also is risk of unintended consequences and downstream effects so it is important to consider all stakeholders involved.

2. According to Shanafelt et al, what are the three pillars of Wellness-Centered Leadership?
  - a. Inspire change, listen to others and incorporate their feedback, care about people always.
  - b. Care about people always, cultivate individual and team relationships, inspire change.
  - c. Listen to others, cultivate individual and team relationships, mindfulness.
  - d. Cultivate individual and team relationships, inspire change, mindfulness.

**Correct Answer:** The correct answer is option b, care about people, cultivate individual and team relationships, and inspire change. Shanafelt et al (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8078125>) studied several leadership philosophies and compiled them into a single framework called “Wellness-Centered Leadership.” Element 1 is “care about people always” to build important relationships to help their team thrive, which leads into Element 2: “cultivate individual and team relationships.” By having respect for the individual and investing in them, it nurtures the relationship and unlocks their maximal potential. Element 3 is “inspire change” and to encourage team members to think beyond the current state and cultivate intrinsic motivation for change.

#### Protection of Human and Animal Subjects

The study was performed in compliance with the World Medical Association Declaration of Helsinki on Ethical Principles for Medical Research Involving Human Subjects, and was reviewed by UCLA Institutional Review Board.

#### Funding

This research was supported by NIH National Center for Advancing Translational Science (NCATS) UCLA CTSI Grant Number UL1TR001881.

#### Conflict of Interest

None declared.

#### Acknowledgments

The authors would like to acknowledge UCLA Health Resident Informaticist Program, UCLA Physician Informatics Group, UCLA librarians, and Information Services and Solutions.

#### References

- 1 Stevens JP, Nyweide D, Maresh S, et al. Variation in inpatient consultation among older adults in the United States. *J Gen Intern Med* 2015;30(07):992–999
- 2 Silva SA, Valácio RA, Botelho FC, Amaral CF. Reasons for discharge delays in teaching hospitals. *Rev Saude Publica* 2014;48(02):314–321
- 3 Shieh L, Chi J, Kulik C, et al. Assigning a team-based pager for on-call physicians reduces paging errors in a large academic hospital. *Jt Comm J Qual Patient Saf* 2014;40(02):77–82
- 4 Silow-Carroll S, Edwards JN, Rodin D. Using electronic health records to improve quality and efficiency: the experiences of leading hospitals. *Issue Brief (Commonw Fund)* 2012;17:1–40
- 5 Weigert RM, Schmitz AH, Soung PJ, Porada K, Weisgerber MC. Improving standardization of paging communication using quality improvement methodology. *Pediatrics* 2019;143(04):e20181362
- 6 Chandiramani A, Gervasio J, Johnson M, Kolek J, Zibrat S, Edelson D. ‘Who’s covering this patient?’ Developing a first-contact provider (FCP) designation in an electronic health record *Jt Comm J Qual Patient Saf* 2018;44(02):107–113
- 7 Saleem JJ, Frankel RM, Doebbeling BN, Patterson ES. Patterns in patient safety with computerized consult management and clinical documentation. In: *Proceedings of the International Symposium on Human Factors and Ergonomics in Health Care* 2014:134–141
- 8 Dalal AK, Schnipper JL. Care team identification in the electronic health record: a critical first step for patient-centered communication. *J Hosp Med* 2016;11(05):381–385
- 9 Dalal AK, Schnipper J, Massaro A, et al. A web-based and mobile patient-centered “microblog” messaging platform to improve care team communication in acute care. *J Am Med Inform Assoc* 2017;24(e1):e178–e184
- 10 Thepree T, Shanes E, Maurer D, et al. A new era in pathology consultation: the mypathologist electronic consultation tool. *Acad Pathol* 2018;5:2374289518798820
- 11 Stevens JP, Johansson AC, Schonberg MA, Howell MD. Elements of a high-quality inpatient consultation in the intensive care unit. A qualitative study. *Ann Am Thorac Soc* 2013;10(03):220–227
- 12 Rahman AS, Shi S, Meza PK, Jia JL, Svec D, Shieh L. Waiting it out: consultation delays prolong in-patient length of stay. *Postgrad Med J* 2019;95(1119):1–5
- 13 Eschenroeder HC, Manzione LC, Adler-Milstein J, et al. Associations of physician burnout with organizational electronic health record support and after-hours charting. *J Am Med Inform Assoc* 2021;28(05):960–966
- 14 Guo U, Chen L, Mehta PH. Electronic health record innovations: helping physicians - one less click at a time. *Health Inf Manag* 2017;46(03):140–144
- 15 Williams MS. Misdiagnosis: burnout, moral injury, and implications for the electronic health record. *J Am Med Inform Assoc* 2021;28(05):1047–1050
- 16 Saag HS, Shah K, Jones SA, Testa PA, Horwitz LI. Pajama time: working after work in the electronic health record. *J Gen Intern Med* 2019;34(09):1695–1696