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Brief Communications

Ctrl-C: a cross-sectional study of the electronic health record usage patterns of US oncology clinicians

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Abstract

Despite some positive impact, the use of electronic health records (EHRs) has been associated with negative effects, such as emotional exhaustion. We sought to compare EHR use patterns for oncology vs nononcology medical specialists. In this cross-sectional study, we employed EHR usage data for 349 ambulatory health-care systems nationwide collected from the vendor Epic from January to August 2019. We compared note composition, message volume, and time in the EHR system for oncology vs nononcology clinicians. Compared with nononcology medical specialists, oncologists had a statistically significantly greater percentage of notes derived from Copy and Paste functions but less SmartPhrase use. They received more total EHR messages per day than other medical specialists, with a higher proportion of results and system-generated messages. Our results point to priorities for enhancing EHR systems to meet the needs of oncology clinicians, particularly as related to facilitating the complex documentation, results, and therapy involved in oncology care.

Despite evidence of positive effects on quality and safety (1), use of electronic health records (EHRs) is associated with negative effects, such as emotional exhaustion, a component of burnout (2). Previous studies have suggested opportunities for EHR design to better meet the needs of oncologists (3). Although evidence of differences in EHR use across specialties (4) and among primary care specialties (5) exists, patterns of EHR use among oncologists vs other medical specialists are not well understood. We sought to characterize these differences by using EHR use data from ambulatory health systems from across the United States to improve design and reduce EHR burden.

We conducted a cross-sectional study of EHR usage data for 349 ambulatory health-care systems collected from the vendor Epic from January to August 2019. Data were aggregated at the specialty level within each health-care system. Our sample included all physicians and advanced practice professionals with scheduled appointments. Clinicians subcategorized as oncologists were compared with nononcology medical specialists, as previously defined (4). Nononcology medical specialties included cardiology, general endocrinology, allergy/immunology, gastroenterology/hepatology, geriatrics, hematology, infectious disease, nephrology, orthopedics, pulmonology, rheumatology, and reproductive endocrinology. Health-care systems that did not have oncology clinicians were excluded. EHR use was measured by the Epic Signal metadata extraction tool, which tracks all active EHR interactions. Nonactivity periods longer than 5 seconds, nonclinical tasks (administration or research), and nonambulatory patient visits were excluded (4).

Descriptive statistics with 2-tailed *t* tests and unequal variances were used to compare note composition, measured as the proportion of note characters across note-writing modalities, message volume, and EHR time breakdown between oncology and other medical specialty clinicians. We used ordinary least squares regression to examine the relationship between being an oncology clinician and EHR time, adjusting for organizational characteristics and mean daily patient volume. Analyses were conducted using Stata statistical software, Version 17.0 (StataCorp, College Station, TX), with a 2-sided $\alpha = .05$.

Overall, 318 of 349 health-care systems in the sample included oncology clinicians and were included in the study. Health-care systems in our sample had a mean (SD) 1501 (1604) physicians and a mean (SD) 1 195 466 (1 309 959) annual outpatient visits, demonstrating a skew towards large health-care systems. Mean daily patient volume was 9.4 vs 9.6 patient encounters per day for oncologists vs other medical specialists.

Oncologists had a greater percentage of notes derived from Copy/Paste functions than other medical specialists (38% vs 23%, $P < .001$) and had less SmartPhrase use (41.0% vs 49.5%, $P < .001$) or manual text entry (7.5% vs 11.0%, $P < .001$) (Figure 1, A). Compared with other medical specialists, oncologists received

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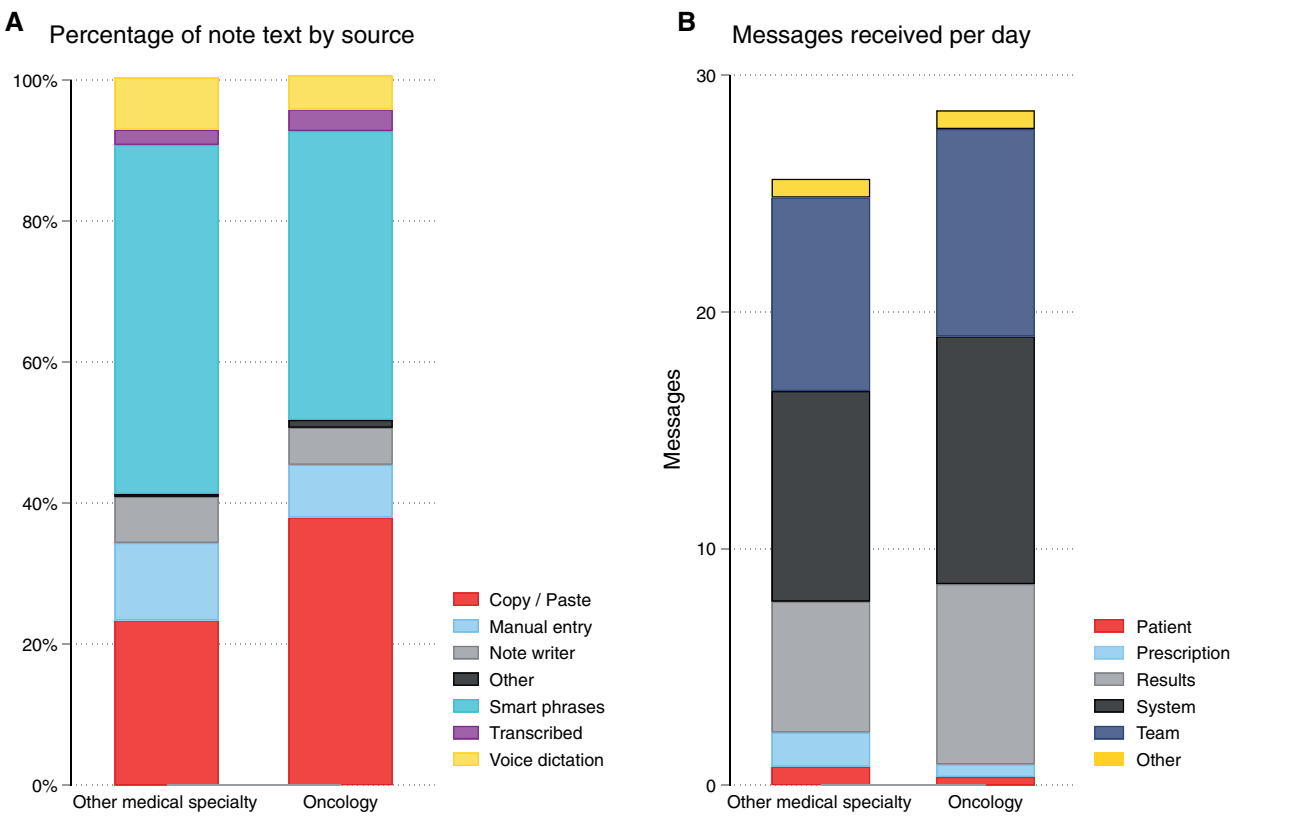

Figure 1. Documentation and InBasket messaging between oncologists and other medical specialists. **A**) Note composition, by source; **B**) messages received per day, by source.

more total EHR messages per day (28.3 vs 25.4, $P < .001$), with a higher proportion of results (7.6 vs 5.5, $P < .001$ and system-generated messages (10.5 vs 8.9, $P < .001$) and fewer prescription (0.5 vs 1.4, $P < .001$) and patient messages (0.3 vs 0.8, $P < .001$) (Figure 1, B).

In aggregate, oncologists spent less time per appointment in the EHR system across Clinical Review, Notes, Orders, and InBasket activities than other medical specialists (Figure 2). In adjusted analyses, these differences translated to oncologists spending less time in the EHR system per appointment than other medical specialists ($\beta = -3.10$ minutes, 95% confidence interval $= -3.69$ to -2.52, $P < .001$).

In this cross-sectional, nationwide study, we demonstrate differences in EHR use patterns for oncologists compared with other medical specialists. The findings suggest priorities for enhancing EHR design to meet the needs of oncologists.

Note composition represents a significant portion of clinical burden, and our work highlights oncologists' reduced use of efficiency tools such as SmartPhrases and greater use of Copy/Paste functions for writing notes. Copy/Paste, in some studies, has been associated with note bloat and inaccurate documentation (6,7). Alternatively, it is possible that because oncologists see patients whose assessment and plan stay relatively stable over time, they have a less need for SmartPhrases to facilitate generation of new documentation, and structured oncology data elements may better meet their needs.

In addition, oncologists appear to have a greater burden of messages received per day, with higher volumes of results-related and system-generated messages (Figure 1, B). The need for multidisciplinary, complex care for oncology patients may drive such differences, with oncologists necessarily receiving a variety of alerts for their patients. Some system-generated messages can be clinically meaningful (eg, reminders that completion of labs or imaging orders are overdue), but system-generated messages have also been associated with a higher probability of burnout and physicians' intention to reduce clinical work time (2,8). Given that the number of patient-initiated messages, which take significant clinician time and effort, have increased dramatically following the COVID-19 pandemic (9), reducing the burden associated with results and system-generated messages may be particularly beneficial.

Our findings have important implications for practicing oncologists and health-system leaders seeking to address the clinician burnout crisis. Although recent efforts by policymakers and professional societies such as the American Medical Association have focused primarily on reducing EHR documentation burden (10), our findings suggest that oncology-specific efforts may focus on the EHR inbox. Specific interventions, such as enhancing team-based workflows, engaging members of the care team in triaging and responding to messages, streamlining system-generated messages, and providing dedicated time during clinic hours for inbox work, may be effective methods of reducing oncologist EHR burden (11,12). Improving data capture in structured locations may also enable oncologists' use of efficiency tools to improve the accuracy of documentation and physician well-being. Future research in oncology and elsewhere should carefully consider how best to target EHR burden reduction interventions to the specific clinician population under study.

Our study is strengthened by the availability of EHR use data from oncologists across the United States. Given the data available through Epic Signal at a national level, however, we were unable to segment oncologists as surgical, medical, or radiation

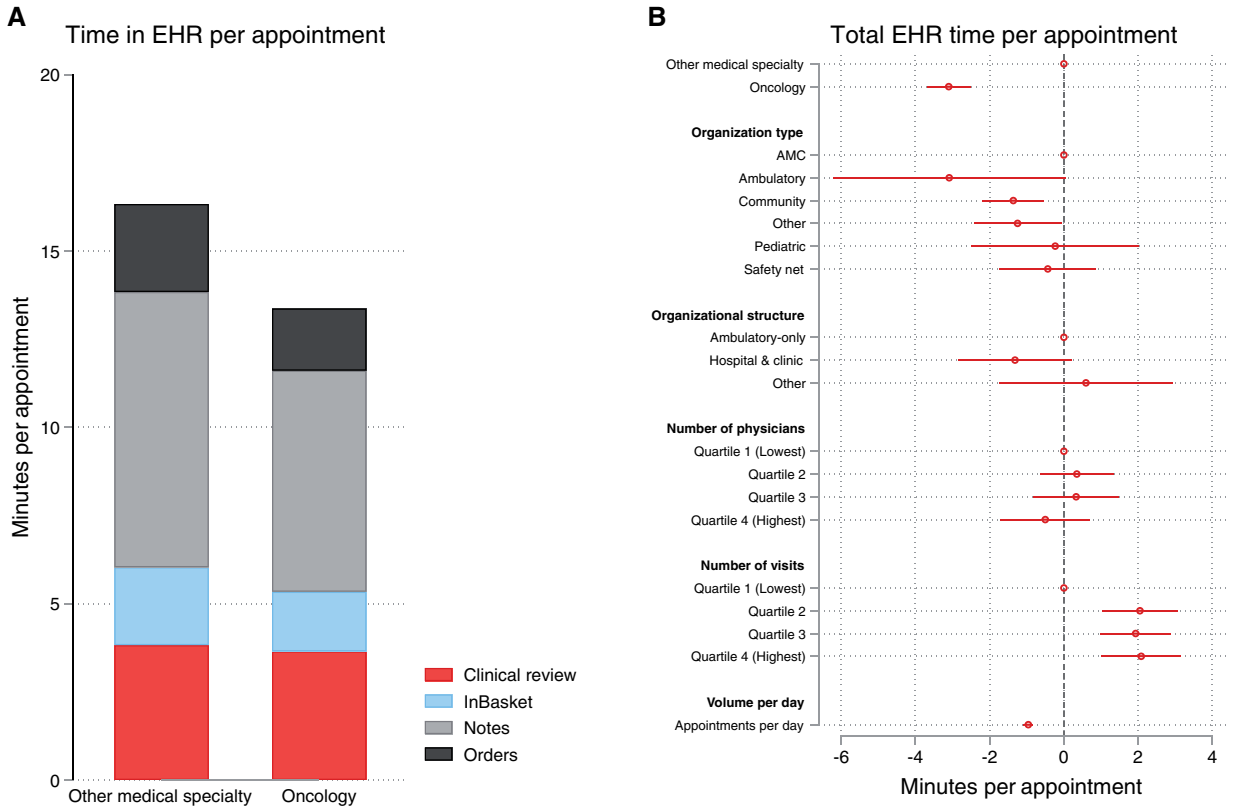

Figure 2. Time distribution in EHR. **A**) Time in the EHR system per appointment; **B**) total EHR time per appointment, by system characteristic. AMC = academic medical center; EHR = electronic health record.

oncology clinicians; analyze patterns of EHR use for inpatient care delivery; compare adult and pediatric specialists; analyze variation within systems; or differentiate longitudinal from acute care. Finally, although our study relies on data from a single EHR vendor, Epic is the largest ambulatory EHR vendor in the United States (13).

Ultimately, differences in EHR use in by oncologists compared with other medical specialists point to key differences in documentation and messaging that reflect the complex, multidisciplinary care in oncology. These differences suggest potential for further EHR design and workflow optimization for specialty care and highlight the need for further investigation into how documentation and messaging can be optimized to meet the needs of oncology clinicians, potentially by blending observational and qualitative analyses with EHR use data to inform oncology-focused EHR system optimization.

Data availability

The data underlying this article were provided by Epic Systems by permission. Data will be shared on request to the corresponding author with the permission of Epic Systems.

Author contributions

Sumi Sinha, MD (Conceptualization; Data curation; Formal analysis; Project administration; Visualization; Writing—original draft), A. Jay Holmgren, PhD (Conceptualization; Data curation; Formal analysis; Methodology; Visualization; Writing—review & editing), Julian C. Hong, MD MS (Conceptualization; Data curation; Formal analysis; Methodology; Supervision; Visualization; Writing—review & editing), Lisa S. Rotenstein, MD MBA (Conceptualization; Data curation; Formal analysis; Methodology; Supervision; Visualization; Writing—original draft).

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Conflicts of interest

The authors have no potential conflicts of interest to disclose.

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References

1. Lin SC, Jha AK, Adler-Milstein J. Electronic health records associated with lower hospital mortality after systems have time to mature. *Health Aff*. 2018;37(7):1128–1135.
2. Adler-Milstein J, Zhao W, Willard-Grace R, Knox M, Grumbach K. Electronic health records and burnout: Time spent on the electronic health record after hours and message volume associated with exhaustion but not with cynicism among primary care clinicians. *J Am Med Inform Assoc*. 2020;27(4):531-538.
3. Gajra A, Bapat B, Jeune-Smith Y, et al. Frequency and causes of burnout in US community oncologists in the era of electronic

health records. *J Clin Oncol Oncol Pract*. 2020;16(4):E357-E365. doi: 10.1200/JOP.19.00542.
4. Rotenstein LS, Holmgren AJ, Downing NL, Bates DW. Differences in total and after-hours electronic health record time across ambulatory specialties. *JAMA Intern Med*. 2021;181 (6):863-865.
5. Rotenstein LS, Holmgren AJ, Downing NL, Longhurst CA, Bates DW. Differences in clinician electronic health record use across adult and pediatric primary care specialties. *JAMA Netw Open*. 2021;4(7):e2116375.
6. Tsou AY, Lehmann CU, Michel J, et al. Safe practices for copy and paste in the EHR: systematic review, recommendations, and novel model for health IT collaboration. *Appl Clin Inform*. 2017;8(1):12-34.
7. Asan O, Nattinger AB, Gurses AP, Tyszka JT, Yen TWF. Oncologists' views regarding the role of electronic health records in care coordination. *J Clin Oncol Clin Cancer Inform*. 2018; 2:1-12.
8. Tai-Seale M, Dillon EC, Yang Y, et al. Physicians' well-being linked to in-basket messages generated by algorithms in electronic health records. *Health Aff*. 2019;38(7):1073-1078.
9. Holmgren AJ, et al. Assessing the impact of the COVID-19 pandemic on clinician ambulatory electronic health record use. *J Am Med Inform Assoc*. 2022;29(3):453–460.
10. Apathy NC, Hare AJ, Fendrich S, Cross DA. Early changes in billing and notes after evaluation and management guideline change. *Ann Intern Med*. 2022;175(4):499-504.
11. Fogg JF, Sinsky CA. In-basket reduction: a multiyear pragmatic approach to lessen the work burden of primary care physicians. *NEJM Catal*. 2023;4(5).
12. Sinsky CA, Shanafelt TD, Ripp JA. The electronic health record inbox: recommendations for relief. *J Gen Intern Med*. 2022;37(15): 4002-4003. doi:10.1007/s11606-022-07766-0.
13. Holmgren AJ, Apathy NC. Trends in US hospital electronic health record vendor market concentration, 2012–2021. *J Gen Intern Med*. 2023;38(7):1765-1767.