Chart Completion Time of Attending Physicians While Using Medical Scribes

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Abstract

Medical scribes have become a widely used strategy to optimize how providers document in the electronic health record. To date, literature regarding the impact of scribes on time to complete documentation is limited. We conducted a retrospective, descriptive study of chart completion time among providers using scribes at our organization. A total of 148,410 scribed encounters, across 55 different clinics, were analyzed to determine variations in chart completion time. There was a significant variance in completion time between specialty groups and clinics within each specialty. Additionally, chart completion time was highly variable between providers working in the same clinic. These patterns were observed across all specialties included in our analysis. Our results suggest a higher level of variability with respect to chart completion when utilizing scribes than previously anticipated.

Introduction

The implementation of electronic health records (EHRs) has led to many positive outcomes, including improved efficiency in healthcare delivery and enhancements to care because of provider access to complete and up-to-date information.[1, 2] However, EHRs have also led to some unintended consequences like provider burnout, over-documentation, and stress.[3-6] Health care professionals have some of the highest levels of burnout compared to other professions and the use of EHRs has been implicated as one of the possible factors contributing to burnout.[7-12] Because of the EHR and documentation requirements, many providers experience EHR fatigue and note bloating.[13, 14] Providers are spending an exorbitant amount of time doing computerized provider order entry and after-hours charting; this phenomena is known as "pajama time", where providers are spending time working, at the EHR, after business hours.[3, 6, 7, 15-18] One study noted that for a patient encounter, providers spend an average of 16 minutes and 14 seconds using the EHR; the average patient visit is 15 minutes, so providers are often spending more time documenting in the EHR than they are spending with the actual patient.[16] The majority of this time spent in the EHR is distributed, relatively equally, around three domains: orders, documentation, and chart review. With the excessive time spent in the EHR, both during and outside of work hours, providers have issues creating a work-life balance – many wish they could spend more time with patients.[3, 13, 14]

There are multiple ways to tackle the inefficiencies of the EHR and reduce the volume of time providers spend with the EHR. Medical scribes are one proposed way to alleviate physician documentation burden.[4] Scribes have been aiding in documentation for centuries, but were not part of the medical field until 1975 when they were deployed as nursing scribes.[19] With the massive increase in EHR use in the early 2000s, the scribing industry has risen in popularity. In today's terms, a medical scribe is usually an unlicensed member of the clinical care delivery team who documents the patient encounter for providers in real-time, so that providers can spend more time with the patient and less time in the EHR. Besides documentation, research has suggested that medical scribes can also aid in information gathering and data entry.[20] It has been demonstrated that medical scribes may decrease provider EHR-time, increase patient and provider satisfaction, improve workflow efficiencies and boost billing and reimbursement through the optimization of coding.[21-28]

A systematic review and meta-analysis by Gottlieb et al. [2021] found that changes in satisfaction, patient throughput, and revenue observed with the use of scribes was nearly consistent across the literature. Their analysis consisted of 562,682 patient encounters from 39 different studies. They observed that providers could see more patients per hour and that the use of a scribe resulted in increased relative value units (RVUs), a measure of the relative economic value of the medical services provided.[29] Seven of the nine studies that investigated provider perceptions when working with scribes reported increases in satisfaction. Of the 18 studies that looked at the patient view of scribe use, reports had varying findings. Some reports suggested that scribes did not change patient satisfaction, while others found increases in patient satisfaction when providers used scribes. One important thing to note about this study is that even though the studies consisted of 562,682 encounters, there was such heterogeneity regarding both study design and measures used, that the authors could not perform a meta-analysis on all of the data elements, such as provider satisfaction.[30]

While research has suggested that scribes can decrease provider burnout by decreasing EHR documentation burden, there is a gap in the literature on whether using scribes leads to better chart closure and documentation. This is of particular concern, considering that there have been mixed results as to the quality of scribed documentation. One

study showed that scribe notes have a higher documentation quality than non-scribed notes.[31] Other studies noted variability in the accuracy of the scribed note.[32, 33] Some institutions have looked at chart closure time with scribe use.[34-37] One outpatient ophthalmology clinic used audit logs of EHR data to investigate the scribes' impact on clinical documentation; their results showed that providers who used scribes had overall less documentation time, but were spending more time documenting after the visit when using a scribe.[35] Another study conducted in an outpatient oncology department reported that providers who used scribes spent less time documenting at the end of the day compared to providers who did not have scribes.[36] A recent meta-analysis found that scribes had a varying impact on documentation completion, with studies ranging from positive to no impact.[27] In another study, there was no difference between providers who used scribes and providers who did not use scribes when it came to chart notes that were incomplete after 72 hours.[38] One potential reason for these varied results is that the vast majority of the studies investigating chart closure time only include one or very few clinics or specialties. These studies may not account for varying workflows and thus researchers cannot compare or contrast chart completion time between different groups. Thus, there is a need to conduct large-scale quantitative studies using multiple clinics, specialties, and subspecialties that examine how scribes impact provider chart closure time.

Oregon Health & Science University (OHSU) piloted a "home grown" scribe program in 2011 for the Center for Women's Health.[39, 40] In 2015, it became a formal internal scribe program, which has since expanded to include over 80 clinics across OHSU. The size, duration, and breadth of the program is uniquely positioned to perform a large-scale quantitative analysis of the impact of scribes on provider documentation patterns. Thus, the goal of this study was to use EHR data to determine the impact of scribes on chart closure time across the institution, and determine factors associated with differences in completion time.

Methods

Setting and Participants. This study was conducted at a large academic medical center in Portland, Oregon. We included data from the EHR (EpicCare; Epic Systems Corporation, Verona, WI) for all ambulatory encounters that occurred between 2015 through 2019, where a medical scribe contributed to documentation. The OHSU Scribe Program almost exclusively services outpatient clinics. Thus, we only included encounters that occurred in outpatient settings. We excluded encounters if they remained unclosed at time of data collection. Encounters scheduled on Saturday or Sunday were excluded from our sample to minimize the effect of potential workflow differences between weekday and end weekend clinic service. We excluded scribes coupled with advanced practice providers because of the small sample size. Finally, to minimize irregularities due to providers who do not regularly see patients, we only included encounters belonging to physician-scribe dyads if they had completed documentation for at least 100 encounters together. This study was reviewed and approved by the institutional review board at OHSU (STUDY00017599).

Data Extraction and Processing. We extracted encounter log data from the EHR, for all ambulatory documentation, where actions on patient records were linked to an EpicCare user identifier (ID) of a medical scribe. We collected the following encounter-level concepts: patient ID, visit ID, physician ID, and scribe ID. Additional meta-data about the specialty and subspecialties of outpatient clinic providers were also extracted. We created a categorical variable to identify the outpatient clinic specialty groups included in our analysis: medicine, surgery, obstetrics and gynecology (Ob-Gyn), and pediatrics. These groups were defined based on high-level differences between the workflows of the specialties. We then generated a set of identifiers to capture the nesting of scribes within physicians, the physicians within clinics, and the clinics within specialty groups.

Descriptive Statistics. For each nested level of analysis, we calculated the median and interquartile range of time to complete chart notes by finding the difference between the scheduled visit date and the date the encounter documentation was completed by the physician. Finally, we also determined the percentage of charts that were completed according to organizational policies: "on time" documentation was closed in less than 14 days, "late" documentation was closed within 14 to 28 days, and "delinquent" documentation was completed sometime after 28 days.

Statistical Analysis.

Descriptive statistics were provided for physicians, scribes, and physician-scribe dyads across our entire sample (Table 1). Continuous variables with normal distribution were presented as mean ± standard deviation, while non-normal variables were reported as median [interquartile range]. We then included data from medicine specialty clinics to illustrate the trends repeatedly observed for documentation completion time across all specialties and clinics in our sample (Figures 1 and 2). Kruskal–Wallis tests were used to compare the mean chart completion time of three or more

groups (i.e. specialty, clinic, and provider). Where significant, a Dunn's post hoc test was carried out on each pair of specialty groups. P-values were adjusted using Bonferroni correction. The frequencies of categorical variables (chart closure type) were compared using Fisher's exact test, when appropriate. Descriptive and inferential statistics were performed in R v4.0.3 (R Foundation for Statistical Computing, Vienna, Austria). Unless otherwise noted, we set a level of significance of $p < 0.05$ for all hypothesis testing.

Table 1. Counts of the Unique Levels of Each Categorical Variable.

Variable	No.[1]
Encounters	148,410
Patients	64,514
Physician-Scribe Dyads	325
Scribes	127
Providers	129
Clinics	55

[1]Number of unique values.

Results

Sample Characteristics. The purpose of this study was to examine chart completion time of attending physicians using medical scribes across a variety of clinical environments. The final sample consisted of 148,410 ambulatory encounters across 55 different outpatient clinics (Table 1). Care clinics were grouped into one of four general specialties which included medicine (69,209; 47%) surgery (48,448; 32.5%), Ob-Gyn (21,326; 14.5%), and pediatrics (9,427; 6%). The types of visits accounted for in each specialty group are included in Table 2.

Table 2. Visit Types Across Clinical Specialty Groups.

	No. (%) of visit types		
Specialty	Office visit	Procedure	Prenatal
Medicine	59,499 (40)	7,078 (5)	2,632 (2)
Surgery	47,820 (32)	628 (0.5)	0 (0)
Pediatrics	9,425 (6)	2 (0)	0 (0)
Ob-Gyn	12,996 (9)	702 (0.5)	7,628 (5)
All	129,740 (87)	8,410 (6)	10,260 (7)

Abbreviation: Ob-Gyn, obstetrics and gynecology.

Our analysis included a total of 129 physicians and 127 scribes (Table 1). On average, physicians had worked with 3±2 scribes in our sample. Scribes had a mean employment length of 14±10 months and worked with anywhere from 1 to 9 physicians. We included a total of the 325 physician-scribe dyads in our final analysis. Of these dyads, 161 (50%) worked in medical specialties clinics, 76 (23%) worked in surgical, 65 (20%) worked in Ob-Gyn, and 23 (7%) worked in pediatrics. On average, dyads worked together over a 10 [6, 17] month period and documented 296 [159, 525] encounters together.

Chart Completion Time. Time to complete chart notes was highly right-skewed and observed a log-normal distribution. Less than half of all chart notes (72,306; 49%) were complete within 24 hours. The median number of days to complete encounter documentation was 0.95 [0.11,5.9] days and ranged from 0.00069 to 854 days. Finally, 132,700 (89%) of the 148,410 charts were closed on time according to organizational policies. Of the remaining, 11,734 (8%) of the completed records were considered late, while 3,976 (3%) were delinquent.

Chart Completion Time by Specialty and Clinic. Chart completion time was most consistent (least spread) in pediatrics with a median chart completion time of 1 [0,3] days (Figure 1). Surgery had the lowest median completion time (0 [0,5] days), while Ob-Gyn had the highest (1 [0,10]). Difference in mean ranks of time to complete chart notes were highly statistically

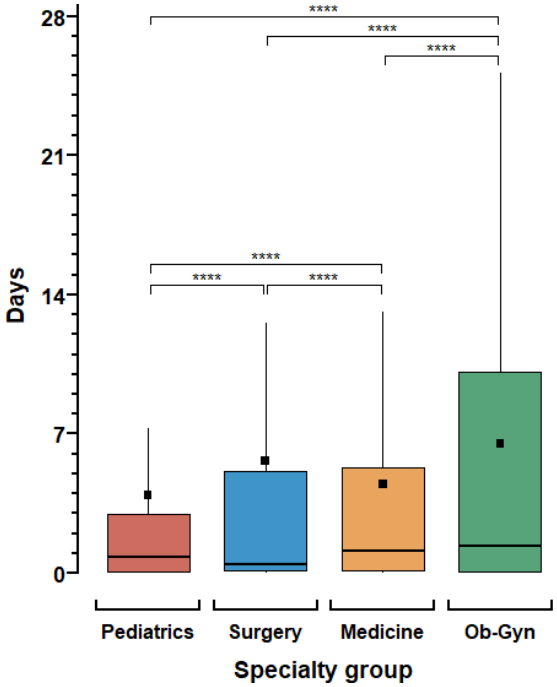

Figure 1. Days to Complete Chart Notes by Specialty Group.

Abbreviation: Ob-Gyn, obstetrics and gynecology.

The upper and lower ends of the boxes indicate the first and third quartiles. The horizontal line inside the box indicates the median and the square indicates the mean. The whiskers indicate values within 1.5x the interquartile range from the upper or lower quartile (or the minimum and maximum value if within 1.5x the interquartile range of the quartile).

The mean ranks of time to complete chart notes were different between groups ($p < 0.0001$). Brackets over bars indicate specialty groups that were statistically significant; **** indicates $p < 0.0001$.

significant between specialty groups ($p < 0.0001$) with significant follow-on differences between each of the group-pairs ($p < 0.0001$).

We next sought to determine whether a similar variance was present within a given department. Overall, each specialty demonstrated a high degree of variance between their subspecialty clinics. As an exemplar, data from the medical specialty clinics are found in Figure 2. Here, the number of days to complete chart notes was also highly variable. The

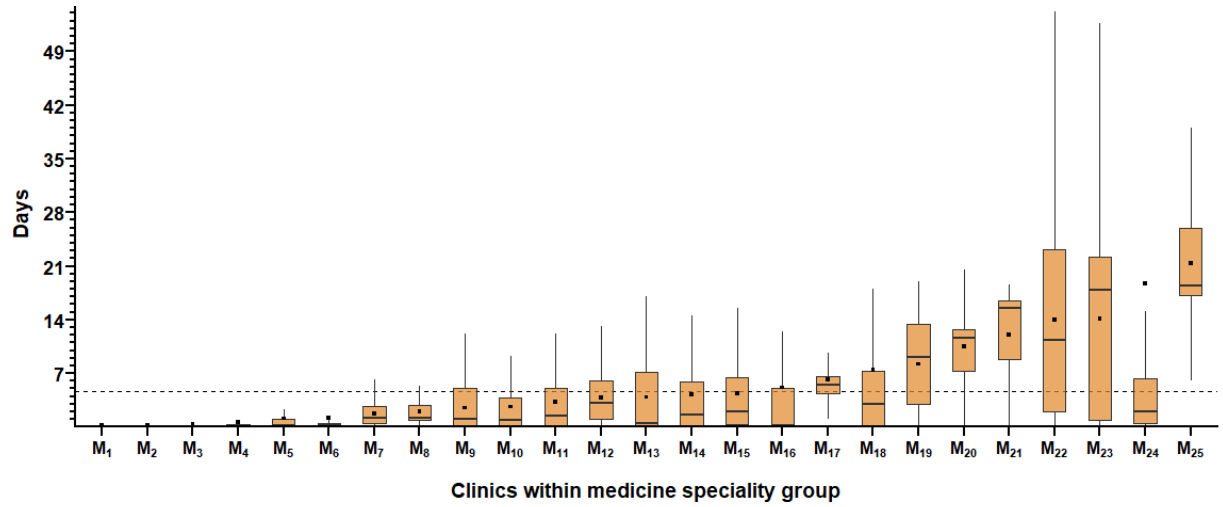

Figure 2. Days to Complete Chart Notes Within Medicine Specialty Clinics.

Each medicine clinic is represented on the x-axis by their ID ($M_{1\text{-}25}$). The dashed, black line represents the overall sample mean.

Statistical components of the boxplots are explained in the first footnote to Figure 1.

median number of days to complete chart notes ranged from 0.03 to 18 days. For some clinics, like *M_{22} and M_{23}* the distribution of days to complete chart notes was highly skewed, with a substantial number of encounters closed after an extended period.

We next wished to determine whether this variance existed within given outpatient clinics. To explore the differences in completion time between providers within the same clinic, we limited the analysis to specialty clinics with at least five scribe-using providers (Figure 3). Overall, differences in mean ranks of completion time for these four clinics were highly statistically significant between groups ($p < 0.0001$) and multiple comparison tests suggested that each clinic's completion time was statistically significantly different from each of the others (all adjusted p-values were <

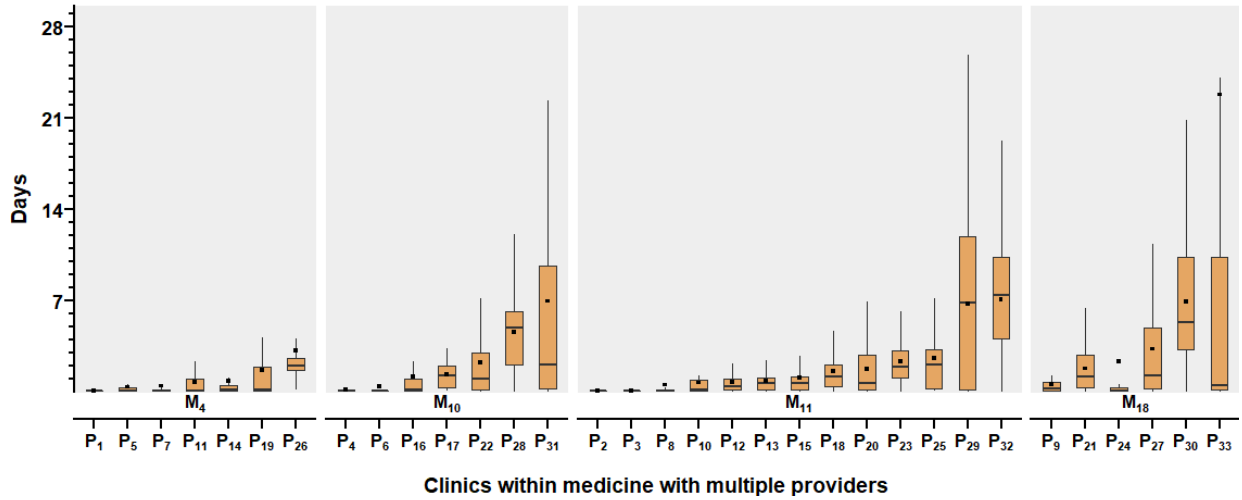

Figure 3. Days to Complete Chart Notes for Physicians Within Medicine Specialty Clinics of Five or more Providers.

Each medicine clinic is shaded in gray and represented above the x-axis by their IDs (M_4, M_{10}, M_{11}, and M_{18} correlate to Figure 2). Each provider within a given clinic is represented on the x-axis by their ID (P_1).

Statistical components of the boxplots are explained in the first footnote to Figure 1.

0.0001). More importantly, within each clinic, there was a highly statistically significant difference in completion time between providers ($p < 0.0001$ for each clinic), suggesting that the observed variability seen across clinics is driven by variability at the individual provider-level.

Visit Day of Week & Days to Complete Chart Note. We next sought to determine what factors may explain some of the inter- and intra-provider variance and initially focused on the encounter day of the week. The total number of encounters that occurred each weekday was relatively similar. The highest number of encounters took place on Thursday (35,244; 24%), followed by Tuesday (33,100; 22%). In contrast, the lowest number of encounters occurred on Fridays (24,062; 16%), Monday (27,848; 19%), and then Wednesday (28156; 19%). The number of days to close chart notes was statistically significantly different across each day of the week that encounters were scheduled ($p < 0.0001$). Encounters that occurred on Thursdays and Fridays had a notably higher average number of days to complete chart notes than the other days of the week (Figure 4). Encounters that occurred on Thursdays and Fridays also had lower percentages of chart notes that were not completed "On Time" compared to the other days of the week (Table 3).

Chart Closure Day of Week & Days to Complete Chart Note. The number of charts closed each day of the week decreased throughout the workweek: Monday (29,6461; 20%), Tuesday (28,969; 20%), Wednesday (27,7701; 19%), Thursday (25,4151; 17%), and Friday (19,1761; 13%). Providers can complete documentation on the weekends and our results suggest that around one in ten chart notes were completed on either Saturday (6,450; 4%) or Sunday (10,984; 7%). For charts where documentation was completed on a Saturday or Sunday, the number of days to complete the chart note was nearly double that of charts completed during the week (Figure 5). When chart documentation was completed on a Saturday or Sunday, the number of delinquent or late closures was higher than all other days of the week (Table 3).

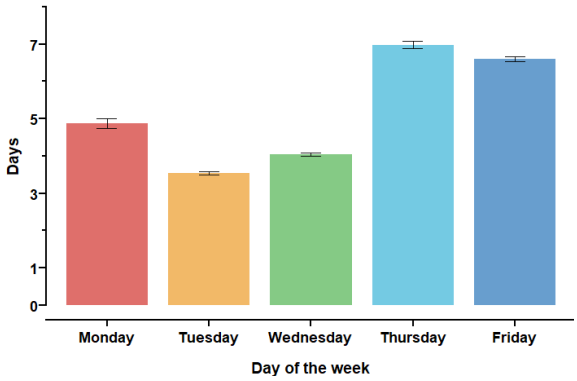

Figure 4. Mean Days to Complete Chart Notes by Encounter Day of Week.

Error bars represent standard error of the mean.

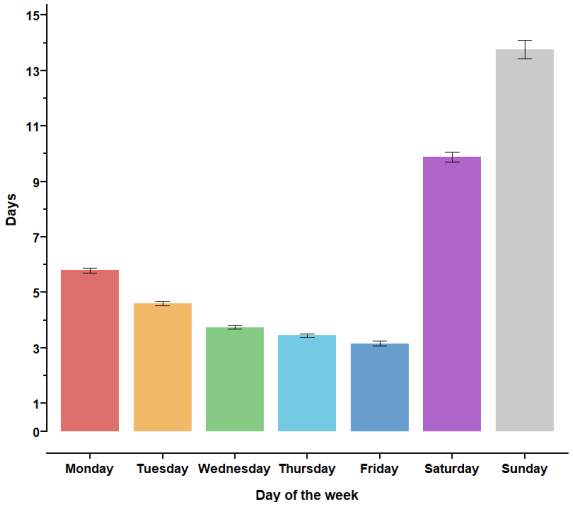

Figure 5. Mean Days to Complete Chart Notes by Chart Closure Day of Week.

Error bars represent standard error of the mean.

Table 3. Classification of Chart Closure, by Encounter Day of Week and by Chart Closure Day of Week.

	No. (%) of closure type[1]		
Event by day of week	**On time**	**Late**	**Delinquent**
Encounter occurred			
Monday	26,079 (93)	1,359 (4.8)	718 (2.6)
Tuesday	31,114 (94)	1,660 (5.0)	326 (1.0)
Wednesday	25,518 (92)	1,951 (7.0)	379 (1.4)
Thursday	30,517 (87)	3,094 (8.8)	1,633 (4.6)
Friday	19,472 (81)	3,670 (15)	920 (3.8)
Chart closure			
Monday	26,264 (89)	2,540 (8.6)	842 (2.8)
Tuesday	26,081 (90)	2,263 (7.8)	625 (2.2)
Wednesday	25,763 (93)	1,587 (5.7)	420 (1.5)
Thursday	23,435 (92)	1,611 (6.3)	369 (1.5)
Friday	18,041 (94)	865 (4.5)	270 (1.4)
Saturday	5,044 (78)	838 (13)	568 (8.8)
Sunday	8,072 (73)	2,030 (18)	882 (8.0)
All	132,700 (89)	11,734 (7.9)	3,976 (2.7)

[1]Closure type was defined by institutional policies as:
On time, 0 to 14 days; Late 14 to 28 days; Delinquent +28 days.

Discussion

Previous literature regarding the use of medical scribes support their implementation as they are purported to help mitigate providers' burdening challenges of EHR documentation.[27] Despite the appeal of their intended usefulness as documentation assistants, qualities of the timeliness of documentation in the company of a medical scribe remains largely unreported. This study is among the first to quantitatively capture the variation in documentation completion time among physician-scribe dyads and the first to do so over such a wide collection of medical specialties and subspecialties. It is also the first

to explore how documentation completion time manifests across multiple levels of a nested sample of clinics, physicians, and scribes, which provides insight into where causes of variation may arise.

One of the most interesting findings is the wide variance between the major clinical specialty groups and time to complete chart notes. The inconsistency in documentation completion time throughout these groups is not surprising considering the previously reported differences in workflows and EHR use among specialists and primary care physicians.[41, 42] Among scribe users, this variation is also understandable, given that the previous literature suggests that different specialties may not utilize their scribes in the same way.[34, 43-45] When examining documentation completion time between clinics within specialties, we found that this variability existed within the different sub-specialty clinics and providers using scribes within the same clinic. This emphasizes that a large degree of variance that we observed is most certainly linked to characteristics at the individual provider level. Our findings highlight a need to develop strategies to manage variation among scribe users. Organizations need provider-specific training that can be applied during scribe implementation and additional tools, such as a dashboard or data visualization system, which can allow them to identify ineffective users of scribes for intervention.

Many factors may influence the widely observed provider differences in chart completion time. One factor that we were able to consider in this analysis was whether documentation completion time was different depending on the day of the week that a visit takes place or the day of the week on which charts were closed. Day of the week may affect completion time as some providers may be more or less likely to perform documentation activities after-hours or on weekends. Our findings suggest that charts are completed at different rates of time depending on the day of the week of a visit. Furthermore, charts that are closed later in the workweek will have an increasingly higher number of days to complete documentation than those completed earlier in the week. More importantly, our data suggests that at least 10% of scribe-generated chart notes are still being completed during "pajama time". This significant fraction of notes, finalized on weekends, had the longest amount of time between the visit date and the closure of chart notes – documentation completed on Sunday took over double the time to complete chart notes compared to those closed during the workweek. It should be noted that this is currently only assessing weekend "pajama time" and we did not assess after-hours weekday work, which was likely also present, suggesting this may be an even greater effect.[15] However, the idea that, even with scribe utilization, providers are facing after-hours documentation may explain why there are conflicting results on reports of how scribe use impacts provider documentation behaviors.

It is likely that additional factors are influencing the large degree of variance with chart completion time among providers who use scribes. The degree to which providers must correct a scribe-generated note is another likely factor influencing the variance we observed in this sample. First, there may be underlying variability in the quality of the scribe-generated note. Previous simulation studies have suggested that scribe-generated notes contain a wide variance in both note structure and content, as well as discrepancies in their accuracy.[32] While all scribe-generated documentation requires a thorough review by the supervising physician, the inconsistency of notes produced by scribes may inevitably influence the amount of time a physician must expend to review, edit, and sign-off on their chart notes. This is further complicated by previous literature regarding the underlying provider-level variance in the specific content, type of content, and amount of content that is included in encounter chart note documentation.[42] Workflow analysis may be another useful tool that can be used in future studies to ascertain granular details of the influence that scribes have on provider chart hygiene.

Perhaps the largest driver to the degree of oversight providers maintain over scribe note content is the nature of the specific relationship they have with their scribe. Previous work carried out by our group and others have found numerous subthemes that play into this relationship and allow for effective and efficient interactions between the scribe and provider.[21, 22] One critical subtheme that has been identified in the research is the "quality of scribe-provider relationship" and the aspect of trust. Findings suggest that the longer the provider and scribe work together, the higher the level of trust in the relationship can become. This higher degree of trust may be associated with less oversight in the completion and correction in content of the note.[46] Future research should investigate if and how scribe-generated chart notes differ regarding both content and quality of the documentation. Additionally, it would be helpful to determine if the content or quality of the documentation depends on the amount of time taken to complete the chart note.

It is helpful to consider these findings in the context of the limitations of this study. First, our analysis only includes a single, academic medical center, limiting the generalizability of our findings. Likely, the incentives that underlie physician documentation hygiene at an academic medical center are different from that of private practice physicians. For example, the salary of physicians working in private practice may be directly tied to reimbursement claims, which require a completed chart note before the submission of a claim is possible. For academically based physicians, salary

is often tied directly to faculty appointments as opposed to claims reimbursement, which may influence their timeliness to complete documentation. Furthermore, our institution recruits and trains their scribes, who are almost uniformly pre-professional students. Individuals from many different professional groups can serve as scribes (medical assistants, nurses, etc.), and further, a large fraction of scribes are trained and supplied by independent organizations. It will be important in future studies to determine the impact these factors have on completion time and documentation hygiene. This study did not account for the chart completion behaviors of physicians before receiving a scribe. It is possible that some of the physicians who received scribes already had poor documentation hygiene, and thus self-selecting for those providers most likely to be given a scribe in the first place, which may have influenced some of the variance observed in our findings. Further, we did not directly analyze how much of the variation we observed in this study occurred because of the presence of a scribe, and we were unable to account for the impact of confounders. Therefore, while multiple explanatory factors may influence chart completion time, there is a chance that the results presented here are attributable to other ongoing factors that were not captured by this analysis. As a result, it is difficult to know how much of a provider's documentation completion time is associated with the presence of a scribe or these other unaccounted-for factors.

Conclusion

This study assessed a gap in knowledge on how quickly physicians complete documentation while using medical scribes. Across clinical specialties and outpatient clinics, there was substantial variation in the time to complete encounter documentation, and this variation persisted across physicians using scribes within the same clinic. Our findings suggest that individual provider behavior may drive the variation in completion of clinical documentation and that scribes may have little impact on regulating the time to chart completion. Because this variation has the potential to undermine the justifications for the use of scribes, it is important that scribe-users understand this aspect of the physician-scribe dynamic and that interventions are developed to educate scribe-users to take full advantage of the assistance with clinical documentation. It should be noted that clinical documentation in the United States is, on average, almost four times as long as those in other countries; an important factor that has driven the utilization of scribes.[4, 27, 47] This work also brings to the fore a larger issue of institutional and regulatory requirements for documentation. Organizations must consider how matching physician-scribe dyads will achieve the overall goal of scribe implementation, while also recognizing the limitations that scribes will have in altering poor EHR users' underlying behavioral deficits.

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