Comparison of intermittent audit vs daily documentation of pharmacist interventions

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Purpose. To compare an intermittent audit method vs a daily documentation method with regard to the number of interventions documented by clinical pharmacists in the hospital setting.

Methods. A 2-phase pre-post cohort study was conducted at an academic hospital to compare numbers and types of pharmacist interventions documented over an 18-month period before implementation of a daily documentation method (the "pre-phase" period) and during the 6 months after implementation (the "post-phase" period). During the pre-phase period (January 2018 to July 2019), pharmacists prospectively documented interventions on specific audit days. The audit days occurred at approximately monthly intervals. During the post-phase period (July 2019 to March 2020) pharmacists used electronic medical record tools to document interventions daily. The primary outcome was the total number of interventions per day. Values for the pre- and post-phase periods were compared using an unpaired Student *t* test and through interrupted time series analysis.

Results. There were a total of 3,628 interventions (on 14 intermittent audit days) during the pre-phase period and 9,300 interventions (on 163 continuous days) in the post-phase period. The mean (SD) number of reported interventions per day decreased from 259 (82) in the pre-phase period to 57 (33) in the post-phase period ($P < 0.001$). The mean (SD) number of daily reported interventions per pharmacist decreased from 24 (5) in the pre-phase period to 6 (2) in the post-phase period ($P < 0.001$). This decrease was consistent with results of the interrupted time series analysis. There was a decrease in reported interventions at the time of implementation (change from most recent audit day, –125 interventions; 95% confidence interval [CI], –187 to –62 interventions; $P < 0.001$). Similarly, there was a decrease in reported interventions per pharmacist at the time of implementation (change from most recent audit day, –22 [95% CI, –26 to –18] interventions; $P < 0.001$).

Conclusion. A change from intermittent audits to daily documentation of interventions resulted in an approximately 5-fold decrease in the number of interventions recorded by pharmacists.

Keywords: pharmacists; pharmaceutical services; quality indicators, health care; documentation; medication errors; interventions

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The positive impact of clinical pharmacists on patient outcomes in the hospital setting is well established.[1] However, justification of pharmacy services is continually required to maintain or expand existing service capacity for pharmaceutical care.[2] The competition for limited financial resources in hospitals requires ongoing evidence of the benefits of pharmacy services provided beyond drug distribution alone. A key component of this evidence is the documentation of pharmacists' interventions. Thus, a recent national survey in the United States has shown that 80% of hospitals track clinical pharmacist

interventions.[3] However, justification is not the only reason for documentation, especially as it occurs in patients' medical records. Documentation should be driven by the need to facilitate communication between clinicians and also for quality improvement purposes that will lead to better patient care.[4]

National professional organizations have provided guidance on the types of information that should be documented by pharmacists.[4,5] However, the methods used for documentation vary across institutions and internationally. Methods could include paper-based forms, Web-based databases, personal digital assistants, and direct entry into electronic medical record (EMR) systems.[6] Since most institutions in the United States currently use EMRs, which have built-in pharmacist intervention recording capabilities, it is likely that direct EMR documentation is most common in contemporary practice in the United States.[3] Although direct EMR documentation is easier to incorporate into clinical workflow,[7,8] such daily documentation requires additional time, can lead to documentation fatigue, and is susceptible to underreporting.[9] It is possible that intermittent audits (ie, documentation on audit days) instead of continuous daily documentation would provide a more representative sample to quantify pharmacist interventions. However, these strategies have not been previously compared.

The objective of the study described here was to compare an intermittent audit method (1 documentation day per month) vs a daily documentation method with regard to the number of interventions documented by clinical pharmacists in the hospital setting.

KEY POINTS

- Pharmacists routinely document interventions during clinical practice, which is utilized for justification of pharmacy services.
- At one hospital, a change from intermittent audits to daily documentation of interventions resulted in an approximately 5-fold decrease in the mean number of interventions per day recorded by pharmacists.
- Intermittent audits may yield data more representative of the volume of pharmacist activity and thus more suitable for the purposes of justification of services.
- Daily documentation should focus on information that is essential and required to be conveyed to those involved in the care of the patient.

Methods

Ethics. The study was approved as a quality improvement project by the Research Ethics and Governance Office of the Sydney Local Health District (protocol approval number, 2020/QA001).

Study setting. The study was conducted in a 950-bed tertiary referral academic hospital in Australia. Each day during the study period there were an average of 16 ward-based pharmacists who could document interventions. Each pharmacist was responsible for approximately 2 wards on any given day. Each ward comprised approximately 20 to 30 beds. The wards covered by pharmacists were diverse and included all specialties that would be expected at a major referral hospital. The hospital's EMR, Cerner PowerChart (Cerner Corporation, Kansas City, MO) was present throughout the study period. Since prospective order verification by pharmacists is not mandatory in Australia, the time spent by the ward pharmacists was dedicated to clinical activities (eg, chart review, patient counseling, coordination of patient discharge, drug information queries) rather than order entry or verification.

Study design. The investigation was a cohort study with a pre-post design. During the first phase, pharmacists prospectively documented interventions on specific audit days as they occurred. Only interventions made on a given audit day were documented for that day. It was not known to the pharmacists when the next audit would occur ahead of time. The audit days were chosen randomly by the chief pharmacist and occurred at approximately monthly intervals. The days were chosen to obtain a representation of each day of the week (Monday through Friday). In other words, each monthly audit day was a different day of the week. The process was then repeated after 5 monthly audit days were completed. Weekend clinical pharmacy services were not provided throughout the study. The interventions were transcribed from paper forms and entered electronically into a REDCap (Research Electronic Data Capture) database by each pharmacist. Data for the "pre-phase" period were collected from January 1, 2018, onward.

On July 18, 2019, pharmacists switched to daily documentation of interventions within the EMR. Since Cerner incorporates a system called Ad Hoc, which enables documentation of interventions by pharmacists, this method was used during the "post-phase" period. In the post-phase period, monthly audits were no longer routinely conducted. However, since a decrease in reporting was noticed after the switch during the first 6 months, a few additional intermittent audit days were also conducted on December 24, 2019 and on January 22 and February 20, 2020. On these days documentation in the EMR was continued, with notification of pharmacists that the day's interventions would be audited. The decision to audit these days in the post-phase period was made on a month-to-month basis; this was because we had intended to stop such audits after the switch. In summary, there were 2 periods: (1) the pre-phase period of monthly audits, which extended from January 2018 to July 2019; and (2) the post-phase period of daily documentation, which extended from

July 2019 to March 2020. All interventions were documented prospectively as they occurred during both phases of the study.

Pharmacist training. Formal education regarding documentation of interventions in the EMR was provided to pharmacists by an information technology pharmacist in a 1-hour departmental education session at the beginning of the intervention period. At this point pharmacists were expected to commence documenting using the electronic system immediately, and this correlates to the start of the post-phase period. One-on-one sessions were scheduled with pharmacists who were unable to attend the initial education session to ensure all pharmacists received the expected training. Three follow-up training sessions were also conducted in the following 5 months. All one-on-one and follow-up sessions were conducted by the information technology pharmacist for consistency. Support materials consisted of a lanyard card with instructions on how to document consistently, and feedback was regularly given and received at weekly clinical pharmacist meetings to maintain engagement. No additional training was needed for the pre-phase period, as the documentation method in use was the stable, default process that had been in use for a few years.

Data collection variables and definitions. Intervention data were acquired during the pre-phase study period from REDCap and during the post-phase study period using an automated query from the EMR. Interventions were classified as follows:

(1) Process interventions—activities or services. These consisted of 4 main categories: clinical review (comprehensive review of patients' medical records to determine appropriateness of medications), patient counseling (a counseling session was counted once if it involved multiple drugs), drug information (provision of drug information), and community liaison (communicating with a primary care physician or community pharmacist upon patient discharge to optimize transition of care to the community).
(2) Drug therapy interventions—interventions resulting in changes to a patients drug therapy. These were categorized as drug changed, drug ceased, route changed, frequency changed, omitted drug started, drug monitoring changed, drug administration changed, drug duplication avoided, or other changes.

The same intervention data were captured for analysis in the pre-phase and post-phase. The number of pharmacists eligible (ie, rostered to work) to document interventions was also obtained. These intervention categories were adapted from standards of practice for documentation of clinical pharmacy services developed by the Society of Hospital Pharmacists of Australia (SHPA).[5] The categories were selected from these standards to represent interventions that were considered to be clinically meaningful. This included both processes and drug therapy changes that may be useful to facilitate communication between members of the healthcare team.

Outcomes and data analysis. The primary outcome was the total number of interventions per day, which was reported descriptively as a mean with standard deviation (SD). The mean number of interventions per day was compared between the 2 study periods using an unpaired Student *t* test. The interventions were stratified a priori during data collection as process interventions or drug therapy interventions. The number of interventions was also normalized to the number of reporting pharmacists. The proportion of reporting pharmacists for a given day (ie, the number of pharmacists reporting an intervention divided by the total number of pharmacists eligible to report) was also calculated for each audit day in the pre-phase period and every 4 weeks in the post-phase period; these values were reported descriptively. An interrupted time series analysis was conducted to determine the effect of implementing the new documentation system. Measures reported here include the slope pre-phase, change in number of interventions immediately after implementation, change in slope after intervention (ie, the change between pre-phase and post-phase slope), and slope post-phase. A 2-sided *P* value of <0.05 was considered to be statistically significant. All analyses were conducted in STATA 15 (StataCorp LLC, College Station, TX).

Results

Overall comparisons. There were a total of 3,628 interventions recorded during the pre-phase period (14 audit days) and 9,300 interventions in the post-phase period (163 days). The mean (SD) number of reported interventions per day decreased from 259 (82) in the pre-phase period to 57 (33) in the post-phase period ($P < 0.001$). The interventions were also stratified by type (process interventions vs drug therapy interventions). The mean (SD) number of process interventions per day decreased from 214 (75) in the pre-phase period to 43 (26) in the post-phase period ($P < 0.001$); drug therapy interventions per day decreased from 45 (14) in the pre-phase period to 14 (10) in the post-phase period ($P < 0.001$). Comparative data on intervention subtypes in the 2 time periods are reported in Table 1. All intervention subtypes were reported to a lesser extent in the post-phase period; these differences were statistically significant for all subtypes.

Intervention trend over time. In the interrupted time series analysis (Figure 1), there was a decreasing slope in intervention reporting in the pre-phase period (slope, –0.27; 95% confidence interval [CI], –0.45 to –0.09; $P = 0.003$). There was a decrease in reporting on the day of implementation (change from most recent audit day, –125 [95% CI, –187 to –62] interventions; $P < 0.001$). There was a significant upward correction in the slope (ie, the difference between the pre- and post-phase slopes) after implementation (slope, 0.29; 95% CI, 0.10-0.49, $P = 0.004$); this represented a stabilization of the downward trend. The post-phase slope was relatively

horizontal (slope, 0.02; 95% CI, –0.06 to 0.10; P = 0.599). The results confirm a decrease in reporting after implementation. Additional audit days were conducted on December 24, 2019 and on January 22 and February 20, 2020 in the post-phase period, with the audit results entered directly into the EMR. The numbers of interventions on these days were 231, 279, and 228, respectively, and indicated a level of reporting comparable to that in the pre-phase period (these values can be seen as outliers in the post-phase period data plotted in Figure 1).

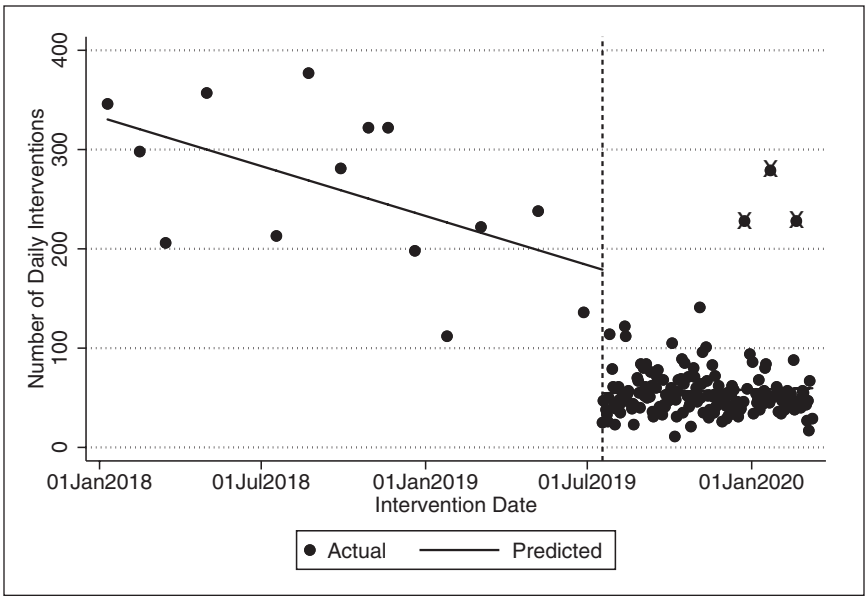
Table 1. Numbers and Types of Pharmacist Interventions

Type	No. per Day, Mean (SD)		
	Before Daily Documentation	With Daily Documentation	*P* Value
Process interventions			
Clinical review	154.2 (54.6)	36.6 (24.0)	<0.001
Patient counseling	12.9 (6.1)	5.2 (3.0)	<0.001
Drug information	24.7 (10.3)	0.6 (0.9)	<0.001
Community liaison	22.2 (12.8)	0.7 (1.5)	<0.001
Drug therapy interventions			
Drug changed	5.1 (2.7)	0.9 (0.9)	<0.001
Drug ceased	5.8 (3.5)	1.2 (1.4)	<0.001
Route changed	0.7 (0.7)	0.1 (0.3)	<0.001
Dose changed	9.5 (3.3)	2.6 (2.3)	<0.001
Frequency changed	4.1 (2.5)	0.8 (1.0)	<0.001
Omitted drug started	9.0 (3.1)	2.3 (1.9)	<0.001
Drug monitoring changed	2.3 (1.9)	0.7 (1.4)	<0.001
Drug administration changed	0.8 (0.7)	0.2 (0.7)	0.006
Drug duplication avoided	2.5 (2.3)	0.7 (0.9)	<0.001
Other changes	5.2 (2.8)	1.4 (4.5)	0.002

Abbreviation: SD, standard deviation.

Interventions adjusted by number of pharmacists. The mean (SD) number of daily reported interventions per pharmacist decreased from 24 (5) in the pre-phase period to 6 (2) in the post-phase period (P < 0.001). In the interrupted time series analysis of interventions per pharmacist (Figure 2), the pre-phase slope had a slightly upward trend (slope, 0.01; 95% CI, –0.00 to 0.03, P = 0.106). There was a decrease in reporting per pharmacist on the day of implementation (change from most recent audit day, –22 interventions [95% CI, –26 to –18]; P < 0.001). There was no significant change in slope (ie, the difference between the pre- and post-phase slopes) after intervention (slope, –0.01; 95% CI, –0.02 to 0.01; P = 0.308). The slope of interventions per pharmacist in the post-phase period was relatively horizontal (slope, 0.00; 95% CI, –0.00

Figure 1. Numbers of interventions over time. The vertical dashed line demarcates the pre- and post-phase periods. Dots with cross in the post-phase period indicate values for the extra audit days, which appear as outliers.



to 0.01; $P = 0.200$). The results confirm a decrease in reporting per pharmacist after implementation. Data on the proportion of eligible pharmacists reporting interventions is graphed in Figure 3 and reported descriptively. The trend appeared to be decreasing with time. After implementation, the proportion of reporting pharmacists increased and remained stable.

Discussion

The key finding of the study was that continuous daily documentation of pharmacist interventions was associated with a reduction in the number of documented interventions compared to intermittent audits. This reduction was found to be 5-fold. The results highlight that daily documentation, which is common in most institutions, greatly underrepresents the value of pharmacy services. Thus, when interventions are used as a metric, they may be very

Figure 2. Number of interventions per pharmacist over time. The vertical dashed line demarcates the pre- and post-phase periods. Dots with cross in the post-phase period indicate values for the extra audit days, which appear as outliers.

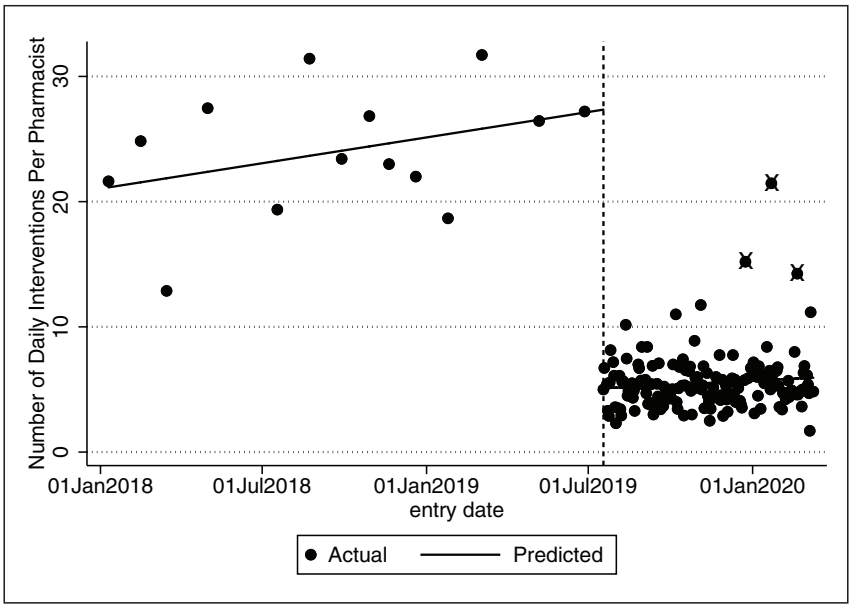
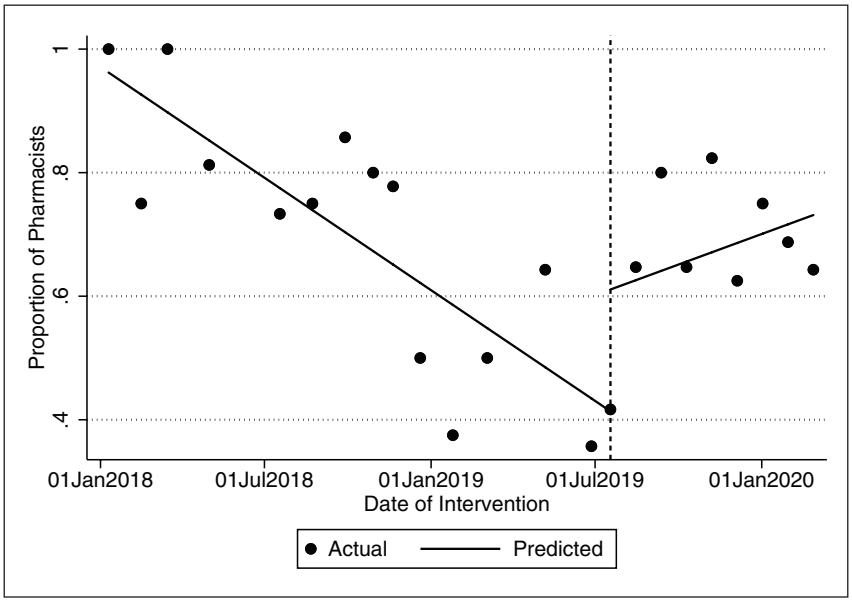


Figure 3. Proportion of pharmacists reporting interventions. Values were calculated every 4 weeks in the post-phase period.



conservative estimates of the services provided by pharmacists. This should be considered by administrators when interventions are used for justification of pharmacy services.

Interventions alone provide a relatively narrow perspective on the care provided by pharmacists. There has been a shift toward performance measurement via the use of quality measures that are patient centered.[10] Value is defined in the context of health outcomes rather than specific interventions. However, there are thousands of quality metrics.[10] In addition, quality metrics that translate into health outcomes usually depend on a range of services that may include pharmacists as one component of care. Thus, it is often difficult to isolate the effect of the pharmacy service alone for many of these measures. This makes it a challenge when competing for limited resources between services that affect the same measure. Also, justification on a continual bases for patient outcomes has some design limitations. For example, a pharmacy service that shows improved pain control in postoperative patients is unlikely to show continued improvements with time. This is because there are thresholds below which further improvements are not necessarily feasible. It is particularly applicable to seasoned or long-standing pharmacy services. In these circumstances, administrators will need to rely on historical data that show benefits from when the service was implemented. As a result, 80% of hospitals in the United States, and to a similar extent internationally, continue to monitor pharmacist interventions on a daily basis.[3,11] Our results show that intermittent audits may provide more appropriate estimates of the quantity of interventions in this context.

An important consideration is the significance or risk level of an intervention. The SHPA *Standards of Practice for Clinical Pharmacy Services* have provided a "consequence/probability matrix" that allows classification of each intervention into a risk category.[5] However, such classification may be subjective and susceptible to interrater differences. It is also not built into the Cerner EMR. Thus, interventions were not classified by pharmacists based on risk level. If this was required, we would have likely expected even less documentation of interventions. It is possible that pharmacists in the post-phase period were selective in their reporting and focused on documenting the higher-risk-level interventions or those more tailored to facilitate communication.[9,11] Direct entry in the EMR also may pose additional barriers beyond time constraints, such as pharmacists' fears of compromising interprofessional relationships or drawing criticism.[12,13] However, we cannot be certain that this occurred because this information was not available to us.

This study focused on the documentation of interventions, which is one component of overall documentation that may occur within the hospital setting. For example, pharmacists may document essential patient care information within the EMR to convey information to other clinicians.[4] The primary intent of this documentation is somewhat different from that of documentation of interventions, but these forms of documentation are not necessarily mutually exclusive. For example, a pharmacist may write a note for therapeutic drug monitoring and then enter an intervention pertaining to the same event. This leads to duplication of efforts and, potentially, double counting during measurement if reports are generated from both notes and interventions. The documentation system used in our study, the Ad Hoc system within Cerner PowerChart, has check boxes for the type of intervention and a free-text field for notes, which the pharmacist could use to write any notes that they deemed necessary. The Ad Hoc notes were viewable by all clinicians within the EMR and hence served the same purpose as a note. Thus, we did not have any double counting in our study, and effort for documentation was minimized. The utilization of templates and checkbox progress notes has been shown to be an effective way to integrate pharmacist documentation in the EMR.[8]

The number of interventions in the 2 study phases were reported in a few different ways to provide different perspectives. Reported metrics included the number of interventions per day, interventions per pharmacist, and proportion of reporting pharmacists. The trend line for the 1.5-year pre-phase period depicts that the number of interventions were on a downward trend. This appears to have been because of a decrease in the proportion of reporting pharmacists over time, whereas the number of interventions per pharmacist was relatively stable. This highlights that some pharmacists were less engaged with the audits over time, which is important for hospitals to consider as audits are implemented and sustained.

During the post-phase period we were concerned that interventions per day had decreased. It was thought that this decrease might have occurred because of the system of documentation or that pharmacists were more cautious with documentation in the EMR because it was visible to all staff. Thus, a few additional audit days were conducted; on those days pharmacists were notified at the start of their shift that the current day would be audited just like in the past. These audit days were similar to those during the pre-phase period, except that the documentation occurred directly in the EMR. These additional audit days showed a considerable increase in the number of interventions (depicted as outliers in the figures), which appeared to be comparable to those during the pre-phase. This indicates that the system of documentation (ie, REDCap vs EMR) was not a contributing factor. Instead, it shows that just notifying pharmacists at the start of their shift that the current day would be an audit day can be a valuable motivator for documentation of interventions.

The study had some limitations in terms of external validity and should be extrapolated with caution. For example, staffing levels may vary between institutions, and this can affect

the time pharmacists have for documentation. We attempted to overcome this limitation by adjusting the data per pharmacist to provide a common denominator. The hospital was using Cerner PowerChart, which is one of the most common EMR systems in the United States and internationally. Other major EMRs are known to have similar functionality. Thus, the results described apply to a large proportion of hospitals that use EMR systems. The study focused on the quantity of interventions rather than the quality of interventions. We are unable to tell if the quality of interventions (ie, whether they were based on risk level, as previously described) changed over time because we did not have this information. It is possible that although the daily documentation resulted in fewer interventions documented, they were of higher quality. Given the numerous different types of patients and wards, it was also not possible to make any conclusions regarding interventions in specific types of patients. However, given that the study was conducted in a large metropolitan hospital, the case mix represented a diverse patient mix that was likely typical of most major hospitals'. We cannot be certain that exactly the same pharmacists were present in both study phases, because there could have been some staff changes. However, as there were no major changes to the hospital staff during the study, any staff changes would be unlikely to have changed the study results.

Conclusion

A change from intermittent audits to daily documentation of interventions resulted in an approximately 5-fold decrease in the number of interventions recorded by pharmacists. We suggest that daily documentation by pharmacists in the EMR should be focused on information that is essential and required to be conveyed to those involved in the care of the patient. Intermittent audits are needed at suitable intervals to more accurately capture the number of pharmacist interventions if needed for the justification of pharmacy services.

Disclosures

The authors have declared no potential conflicts of interest.

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