Original Article

Electronic Clinical Progress Notes as Performance Indicators in Clinical Pharmacy: A Validation Study

Gustavo Cassiano da Silva[1], Mario Vianna Vettore[1]*, Renato Fuller[1], Lavinia Cosmina Ardelean[1]

[1]Department of Postgraduate in Health Sciences, Medical School, Federal University of Goiás, Goiânia, Goiás, Brazil.

Abstract

Hospital clinical pharmacy teams contribute to safer, more effective, and cost-conscious medication use. Evaluating the extent and impact of these services is vital for ensuring care quality, but conventional performance tracking through manual reporting is resource-intensive. This study investigated whether electronic medical record (EMR) progress note counts could reliably indicate clinical pharmacy activity. A sample of 300 adult patient admissions across three Australian hospitals (May–November 2021) was examined. Pharmacy-authored EMR notes were categorized according to their titles and the interventions documented. Using a manual audit as the reference standard, the validity of note counts was assessed via sensitivity, specificity, and positive predictive value. Among 861 audited notes, entries labeled PMM Medication History, PMM Medication Review, and PMM Discharge Medications exhibited strong agreement with manually verified interventions, showing high specificity and predictive accuracy (> 98%) and sensitivities of 98%, 90%, and 89%, respectively. These findings support the use of EMR progress note counts as an accurate, efficient measure of clinical pharmacy service delivery. This approach offers a scalable solution for hospitals seeking streamlined performance assessment. The study received ethical clearance from the Central Adelaide Local Health Network Human Research Ethics Committee (Ref. 16357) and the University of South Australia Human Research Ethics Committee (Ref. 205782), in line with national ethical standards.

Keywords: Clinical pharmacy, Hospital services, EMR, Performance evaluation, Medication management, Healthcare quality

Introduction

Clinical pharmacy services encompass a range of activities performed by pharmacists to optimize medication use and enhance patient safety. Evidence suggests that these services lead to improved clinical outcomes, fewer medication-related complications, and lower healthcare costs. Monitoring the delivery and effectiveness of pharmacy interventions is crucial for quality assurance, identifying effective practices, and supporting resource allocation decisions that ensure the sustainability of services [1-4].

There is no universally accepted method for quantifying clinical pharmacy activities. Documentation practices differ widely, and traditional performance tracking has relied on manual reporting, which is both labor-intensive and time-consuming. Leveraging electronically recorded data offers a more efficient alternative, reducing administrative burden while potentially improving the accuracy of performance metrics [2, 5, 6].

In South Australia, most public hospitals use a standardized electronic medical record (EMR) system with structured progress note templates to document patient care. Pharmacy staff are encouraged to use notes prefixed with 'PMM' (pharmacy medication management), followed by a descriptor that indicates the type of service delivered. Notes labeled 'high-risk medication assessment', 'pharmacy notes', or 'clinical pharmacy intervention' are typically used for targeted medication evaluations, while 'medication history', 'medication review', and 'discharge medications' record comprehensive reviews at admission, during hospitalization, and at discharge, respectively [3-8].

The reliability of these EMR notes as indicators of service delivery has not been established. Understanding whether note counts accurately reflect actual clinical pharmacy interventions is particularly important, as it allows evaluation of services at critical points in patient care, such as transitions during admission and discharge, where the risk of medication

Address for correspondence: Mario Vianna Vettore, Department of Postgraduate in Health Sciences, Medical School, Federal University of Goiás, Goiânia, Goiás, Brazil.
mariovettorevianna@gmail.com
Received: 29 May 2025; **Accepted:** 01 October 2025

How to cite this article: da Silva GC, Vettore MV, Fuller R, Ardelean LC. Electronic Clinical Progress Notes as Performance Indicators in Clinical Pharmacy: A Validation Study. Arch Pharm Pract. 2025;16(4):17-20. https://doi.org/10.51847/n2YuL8SLvh

errors is highest [9-11]. This study aimed to assess whether EMR progress note counts could serve as valid measures of clinical pharmacy services in South Australian public hospitals.

Materials and Methods

Study Design and Setting

This investigation employed a retrospective observational design to examine documentation of clinical pharmacy activities in three South Australian public hospitals: Royal Adelaide Hospital, Flinders Medical Centre, and Noarlunga Health Services. The study focused on adult inpatients (aged 18 years or older) who were admitted for at least 48 hours between May and November 2021. EMR progress notes authored by pharmacy staff during these admissions were manually audited to determine the type of note completed and the corresponding clinical pharmacy service. For this study, a hospital admission was defined as the period from a patient's entry into inpatient, emergency, or waiting-list services until discharge.

Categorisation of Clinical Pharmacy Services

Clinical pharmacy activities were classified using Advanced Pharmacy Australia's (AdPha) framework for patient-specific interventions.7 Certain activities, such as compiling the best possible medication history (BPMH), are recommended at defined stages of a patient's hospital journey [7]. In this study, progress notes were grouped into three service categories based on these recommendations:

- Admission services: Activities conducted at hospital entry, including BPMH and, where applicable, medication reconciliation and review.
- Inpatient assessment services: Comprehensive medication review and reconciliation performed during the hospital stay, potentially accompanied by clinical interventions or recommendations, independent of admission or discharge activities.
- Discharge services: Pharmacy interventions aimed at ensuring safe medication management and continuity of therapy upon patient discharge.

Data Collection

A random sample of 300 eligible patient admissions with EMR-generated clinical progress notes authored by pharmacy staff was selected using a random sequence generator. For each admission, all corresponding progress notes were extracted and manually reviewed by a research pharmacist. The audit involved classifying and counting progress notes based on their titles, and then further categorizing them according to the type of clinical pharmacy service documented. Notes were cross-referenced with BPMH records and patient medication charts to verify whether they encompassed a complete assessment of all prescribed or taken medications. Data were recorded and managed in Microsoft Excel (Microsoft Corp., Redmond, WA, USA) for subsequent analysis.

Data Analysis

Descriptive statistics were used to summarize audit findings. The validity of using EMR progress note counts—specifically PMM Medication History, PMM Medication Review, and PMM Discharge Medications—as indicators of admission, inpatient, and discharge services, respectively, was assessed using a criterion-based approach. The manual audit served as the gold standard. For each note type, entries were classified as true positives, false positives, true negatives, or false negatives based on the alignment between the note's title and the documented clinical service in accordance with hospital documentation guidelines. These classifications were used to calculate sensitivity, specificity, and positive predictive value for each service type.

Results and Discussion

A total of 861 clinical pharmacy progress notes were reviewed across the 300 admissions, as some patients had multiple notes recorded. Of these, 272 notes (31.6%) were PMM Medication History, 221 (25.7%) were PMM Medication Review, 235 (27.3%) were PMM Discharge Medications, 130 (15.1%) were PMM Pharmacy Notes, and 3 (0.3%) had non-PMM titles **(Table 1)**.

Most notes (783, 90.9%) documented services that assessed all of a patient's prescribed medications, whereas 50 notes (5.8%) recorded interventions targeting only a subset of drugs, and 3 notes (0.3%) documented non-clinical activities. Additionally, 25 notes (2.9%) were extensions of previously completed entries; these were not included in total counts, as they did not represent additional clinical service delivery.

Table 1. Types of clinical pharmacy services are documented in every kind of electronic clinical process note.

Title of progress note	All medicines (n, %)	Subset of medicines (n, %)	Extension (n, %)	Non-clinical (n, %)	Total (n, %)
PMM medication history	272 (34.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	272 (31.6%)
PMM medication review	221 (28.2%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	221 (25.7%)
PMM discharge medications	235 (30.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	235 (27.3%)
PMM pharmacy note	55 (7.0%)	50 (100.0%)	22 (88.0%)	3 (100.0%)	130 (15.1%)
Adult Fortress Frailty Management Plan	0 (0.0%)	0 (0.0%)	3 (12.0%)	0 (0.0%)	3 (0.3%)
Total	**783**	**50**	**25**	**3**	**861**

PMM = pharmacy medication management.

Validity of Progress Notes

The performance of PMM Medication History, PMM Medication Review, and PMM Discharge Medications progress notes as indicators of clinical pharmacy services was evaluated against the manual audit, which served as the reference standard **(Table 2)**. These notes demonstrated consistently high specificity and positive predictive values, exceeding 98% across all service types. Sensitivity was also strong, exceeding 89%, though it varied slightly depending on the kind of service. These findings indicate that EMR progress note counts are reliable proxies for documenting the provision of comprehensive clinical pharmacy interventions at admission, during hospitalization, and at discharge.

Table 2. Validity of pharmacy progress notes as indicators of clinical pharmacy service provision.

A combination of pharmacy progress notes and clinical services was tested	True positive	False positive	True negative	False negative	Sensitivity (95% CI)	Specificity (95% CI)	Positive predictive value (95% CI)
PMM medication history and admission services	272	0	584	5	98% (97.1%–99.8%)	100% (99.6%–100%)	100% (99.6%–100%)
PMM medication review and inpatient services	217	4	613	27	89% (86.7%–97.5%)	99% (98.6%–100%)	98% (97.1%–98.9%)
PMM discharge medications and discharge services	235	0	599	27	90% (87.5%–97.8%)	100% (99.6%–100%)	100% (99.6%–100%)

CI = confidence interval; PMM = pharmacy medication management.

This study evaluated the use of EMR-generated progress notes to measure the delivery of clinical pharmacy services in a statewide public hospital system in Australia. Progress notes labeled 'medication history', 'medication review', and 'discharge medications' demonstrated strong validity for capturing admission, inpatient, and discharge services when compared to a manual audit. High positive predictive values indicate that these notes reliably reflect completed pharmacy interventions, while high sensitivities show that most documented services were accurately captured. Additionally, high specificity suggests these notes effectively distinguished instances where services were not provided. Collectively, these findings support the use of EMR progress note counts as accurate indicators of clinical pharmacy activity.

Beyond validity, EMR progress note counts offer practical advantages. They can be extracted efficiently with minimal staffing effort and, when integrated with clinical and administrative datasets, provide valuable metrics for monitoring and evaluating performance. Previous studies have highlighted the benefits of EMR-derived metrics, including increased data volume, accuracy, and efficiency compared to manual chart reviews or coded administrative databases [6, 11, 12].

National clinical governance frameworks advocate for frequent monitoring of services to support continuous quality improvement and emphasize data collection methods that minimize resource demands [7, 13, 14]. Using EMR progress note counts aligns with these objectives by providing a scalable and reliable approach to performance measurement. While coded administrative data can facilitate large-scale monitoring, concerns persist regarding coding accuracy and the absence of time-stamped information, which limits the ability to assess the timeliness of care delivery—an essential aspect of quality evaluation [11, 12, 14].

This study extends prior research by validating EMR progress notes as performance indicators for services provided at distinct stages of hospital admission [6]. Hospitals using semi-structured EMR documentation can adopt similar approaches to derive performance metrics efficiently. For institutions relying primarily on coded administrative data, incorporating targeted codes into EMR progress notes has been shown to improve the detection and measurement of clinical pharmacy activities, enhancing reliability [11].

The findings also identify areas for improvement. Approximately 7% of comprehensive medication assessments were documented under 'PMM pharmacy note', which reduced sensitivity for the primary indicators. Although these notes were not included as performance measures due to their limited scope, future research could involve qualitative audits and consultation with pharmacy staff to understand deviations from recommended documentation practices. Insights from such studies could inform strategies to improve adherence to documentation standards, thereby enhancing the accuracy and sensitivity of EMR-based performance measures.

Future Research

Further investigations could explore ways to enrich the information captured by EMR progress note counts by extracting and analyzing the specific clinical activities documented within each note. Raw counts alone may not fully represent the scope or complexity of services provided. For example, this study classified services according to activities unique to specific stages of hospital admission.

Still, as-needed interventions—such as therapeutic dose monitoring—that may occur at multiple points during hospitalization were not consistently captured. Detailed insights into these activities are essential for evaluating service comprehensiveness and clinical outcomes [7, 11]. While manual audits remain the most accurate method for this purpose, they are inefficient and impractical for large-scale use [11]. Alternative approaches could include querying structured fields within EMR templates or leveraging artificial intelligence, such as large language models, to extract and interpret relevant information from semi-structured or unstructured clinical notes [15]. These technologies hold promise for improving the granularity and efficiency of performance measurement.

Limitations

This study has several limitations. Only documented clinical pharmacy services were assessed, so any interventions performed but not recorded in the EMR were not captured. The extent of such undocumented activities is unknown and would require direct observation of clinical practice. Additionally, the analysis focused exclusively on notes authored by pharmacy staff, which means pharmacy contributions recorded by other healthcare professionals in interprofessional care documentation were not included.

Conclusion

EMR progress notes labeled medication history, medication review, and discharge medications demonstrated strong validity as indicators of clinical pharmacy service delivery, with high sensitivity, specificity, and positive predictive values relative to manual audit. These findings indicate that counts of these progress notes provide an accurate reflection of service provision and can serve as reliable performance measures for clinical pharmacy activities in hospital settings.

ACKNOWLEDGMENTS: None
CONFLICT OF INTEREST: None
FINANCIAL SUPPORT: None
ETHICS STATEMENT: Ethical clearance was obtained from both the Central Adelaide Local Health Network Human Research Ethics Committee (Ref. 16357) and the University of South Australia Human Research Ethics Committee (Ref. 205782). All study procedures were conducted in accordance with the Australian National Statement on Ethical Conduct in Human Research.

References

1. American College of Clinical Pharmacy. The definition of clinical pharmacy. Pharmacotherapy. 2008;28:816–17.
2. Song YK, Jeong S, Han N, Na H, Jang HY, Sohn M, et al. Effectiveness of clinical pharmacist service on drug-related problems and patient outcomes for hospitalized patients with chronic kidney disease: a randomized controlled trial. J Clin Med. 2021;10(8):1788.
3. El-Refae HG, Abuhamdah S. Impact of clinical pharmacist intervention on therapy-related problems and costs in a cardiovascular unit of a tertiary healthcare facility in Amman, Jordan. Trop J Pharm Res. 2017;16(12):3013–21.
4. El-Awaisi A, Al-Shaibi S, Al-Ansari R, Naseralallah L, Awaisu A. A systematic review on the impact of pharmacist-provided services on patients' health outcomes in Arab countries. J Clin Pharm Ther. 2022;47(7):879–96.
5. Jošt M, Kerec Kos M, Kos M, Knez L. Effectiveness of pharmacist-led medication reconciliation on medication errors at hospital discharge and healthcare utilization in the next 30 days: a pragmatic clinical trial. Front Pharmacol. 2024;15:1377781.
6. Pawloski P, Cusick D, Amborn L. Development of clinical pharmacy productivity metrics. Am J Health-Syst Pharm. 2012;69(1):49–54.
7. Dooley M, Bennett G, Clayson-Fisher T, Hill C, Lam N, Marotti S, et al. Advanced pharmacy Australia clinical pharmacy standards. J Pharm Pract Res. 2024;54(6):446-511.
8. Al-Jazairi AS, Alnakhli AO. Quantifying clinical pharmacist activities in a tertiary care hospital using key performance indicators. Hosp Pharm. 2020;56(4):321–7.
9. Barnett A, Winning M, Canaris S, Cleary M, Staib A, Sullivan C. Digital transformation of hospital quality and safety real-time data for real-time action. Aust Health Rev. 2019;43(6):656–61.
10. Sullivan C, Gleason KM, Rooney D, Groszek JM, Barnard C. Medication reconciliation in the acute care setting: opportunity and challenge for nursing. J Nurs Care Qual. 2005;20(2):95–8.
11. Canning ML, McDougall R, Yerkovich S, Barras M, Coombes I, Sullivan C, et al. Measuring the impact of pharmaceutical care bundle delivery on patient outcomes: an observational study. Int J Clin Pharmacol. 2024;46(5):1172–80.
12. Mirkov S, Jones R, Ison A, Wilesmith A, Black J. Design and development of the clinical pharmacy key performance indicators dashboard for equity of service provision at regional and rural hospitals in North Queensland, Australia. J Pharm Pract Res. 2024;54:296–305.
13. Australian Commission on Safety and Quality in Health Care (ACSQHC). National model clinical governance framework. 1st ed. Sydney: ACSQHC; 2017.
14. Pharmaceutical Society of Australia (PSA). Clinical governance principles for pharmacy services 2018. Deakin: PSA; 2018.
15. Burford KG, Itzkowitz NG, Ortega AG, Teitler JO, Rundle AG. Use of generative AI to identify helmet status among patients with micromobility-related injuries from unstructured clinical notes. JAMA Netw Open. 2024;7(8):e2425981.