

Assessing Prescription Data Quality in Pharmacy Information Systems

Norvena Hisham, Maryati Mohd. Yusof*

Faculty of Information Science and Technology, Universiti Kebangsaan Malaysia, Malaysia

*Corresponding author: Maryati Mohd. Yusof (e-mail: Maryati.Yusof@ukm.edu.my)

ABSTRACT

High data quality in pharmacy information systems (PhISs) can support patient management and drug monitoring for efficient healthcare delivery. By contrast, low-quality data can affect patient safety by increasing the risk of medication errors. We assessed the accuracy and completeness of PhIS data, identified the frequency, type and source of discrepancies in patient medication data and suggested appropriate mitigation measures. A cross-sectional study was conducted at the outpatient pharmacy department of a Malaysian public hospital. 310 patient paper prescriptions were randomly selected and compared with matching PhIS data. Approximately 32.3% of the prescriptions contain at least one type of discrepancy. The highest type of discrepancy identified in the 1141 reviewed drugs is the duration of drug supply (9.8%, $n = 112$), whereas 23.4% ($n = 54$) consisted of drugs from the analgesic group. Drug discrepancies were correlated with the number of drug items in a prescription ($p < .005$) and location of an issued prescription ($p < .005$). A small percentage of the assessed PhIS data related to the general prescription and medication regimen were incomplete and inaccurate. Recommended mitigation measures included user training and periodic audits to improve procedural compliance and data quality.

Keywords: pharmacy information systems, data quality, prescribing, evaluation, health information management, health information systems, quality assessment, medication errors, patient safety

INTRODUCTION

High-quality data are critical for ensuring reliable and effective patient treatment. Pharmacy information systems (PhISs) generate high-quality data to reduce errors, increase productivity and enhance pharmacist–clinician synergy. However, PhISs have data quality problems, such as incompleteness and inaccuracy (Elliott et al. 2023; Modig et al. 2022; Ni et al. 2020; Putra and Yusof 2021; Rohani and Yusof 2023), which can be attributed to data discrepancies in paper and digital prescriptions (Rohani and Yusof 2023). Moreover, poor data quality results in medication errors (MEs), which are the leading causes of preventable injury and healthcare issues. Most data transfer and coding errors are caused by human error and unstandardised data entry format (Lim et al. 2018). Over 600 monthly dose- or drug name-related ME incidents that reach patients at an average of one or two incidents annually (Putra and Yusof 2021).

RELATED WORK

Wang and Strong (1996) defined data quality as “data that are fit for use by data consumers”. High-quality data production, which is the main goal of health information systems (WHO 2023), requires accurate data inputs (Getachew et al. 2022) because low-quality data increase the risk to patients' health and are detrimental to health organisations. Complete data elements are the first indicators of data quality (Uwase et al. 2023). System constraints in the production of high-quality data can be identified by assessing and monitoring data quality. In addition, data characteristics determine multidimensional data quality (Lewis et al. 2023; Syed et al. 2023; Wang and Strong 1996). Commonly used dimensions for assessing health data quality are completeness, accuracy, timeliness, consistency and reliability (Mohammed and Yusof 2013; Chen et al. 2014; Lim et al. 2018; Ozonze et al. 2023; Syed et al. 2023). PhISs encounter data quality problems that increase the risks of MEs (Caleres et al. 2020; Gates et al. 2021), and discrepancies in digital medication data with the secondary sources are prevalent (Caleres et al. 2020; Elliott et al. 2023; Modig et al. 2022). These discrepancies involve various data items, such as drug name, dose, frequency and treatment duration (Modig et al. 2022) in different medication stages. For example, prescription data discrepancies include missing medications, incorrectly or incompletely

transcribed drug regimens and illegible prescriptions (Rohani and Yusof 2023) that can lead to MEs, such as wrong dosage (Bülow et al. 2021).

METHODOLOGY

We obtained approval from the ethics and medical research committee and identified patients anonymously. The study objectives are to: 1) assess prescription data quality in a PhIS, 2) identify the frequency, types and sources of discrepancies in patient medication data in the PhIS, and 3) recommend mitigation measures for prescription data discrepancies. We conducted a retrospective study to compare paper and electronic prescription data quantitatively and assess their completeness and accuracy. We used a cross-sectional study design because of its appropriateness for assessing health data quality (Chen et al. 2014; Lewis et al. 2023). We assessed 310 prescriptions at the outpatient pharmacy department (OPD) in a 100-bed Malaysian public hospital, which has high outpatient medication-dispensing operations. The OPD has been using a PhIS since 2015 for all drug-dispensing activities.

The sampling comprises patients who obtained medication supplies from the OPD. We used a random-sampling method (Chen et al. 2014) to select patient prescriptions because of nonsignificant discrepancies among prescription data or specific treatments administered daily or monthly. Author NH randomly selected January and three dates for the assessment, which yielded 311 paper prescriptions. However, only 310 prescriptions met the inclusion criteria but were sufficient for data quality assessment (Chen et al. 2014). We also recruited three professional experts among pharmacy officers to validate our study instruments. These experts had working experience of over 10 years and specific experience in drug dispensing activities and understood the process for using PhIS. Author NH compared 1) the electronic and paper prescriptions of the same patient and 2) patient medication and drug use data in the PhIS. The number of drug items per prescription and the type of drug group were extracted and cleaned using the multiple imputation technique. Data cleaning outcomes showed that all the five items were cleaned (100%), and the missing data value was 0%. Paper prescription was used as a content comparison, although its data may be incomplete and unreadable because prescribers order medication manually and pharmacists use paper prescriptions to enter patient medication data in the PhIS. Both documents' contents were compared according to their data similarities.

RESULTS

The study included a total of 175 male patients (56.5%) and 135 female patients (43.5%). The average age groups were over 60 years old (21.9%; 68), between 41 and 60 years old (30%; 93), between 21 and 40 years old (28.1%; 87) and under 20 years old (20%; 62). For the general prescription data, 5/7 (71.4%) of the items were >95% complete, namely, 'Patient's name' (100%), 'Gender' (100%), 'Date of issued prescription' (100%), 'ID number' (96.8%) and 'Prescription serial number' (95.2%). 'Prescriber name' was 75.5% complete, whereas 'Diagnosis' field was unfilled. All five drug items were 100% complete. Data accuracy assessment results showed the highest error percentage in the 'Diagnosis' item, followed by those in 'Prescriber name' (24.5%; 76/310), 'Patient name' (11.9%; 37/310); 'Prescription serial number' and 'ID number' errors were 4.8% (15/310) and 3.2% (10/310), respectively, whereas 'Gender' and 'Date of prescription issued' had no error. 32.3% (100/310) prescriptions had at least one type of drug data discrepancy, whereas 67.7% (210/310) prescriptions had no drug data discrepancy. Approximately 11.9% (37/310) prescriptions had one discrepancy while 10% (31/310) prescriptions had two discrepancies in drug data. A single prescription had three or more drug data discrepancies (10.3%; 32/310). The mean number of medication discrepancies was 2.6 per patient, and the median was two discrepancies per patient. Approximately 19.5% (222/1141) drugs had drug data discrepancies. We identified seven types of drug data discrepancies: 'Drug Supply Period', 'Drug Frequency', 'Drug Dosage', 'Drugs Excluded in PhIS', 'Drug Form', 'Drug Name Not in Paper Prescription' and 'Other' (other than the types listed). Overall, 'Medication Supply Period' had the highest rate of discrepancies (50.5%; 112/222), followed by 'Medication Frequency' (29.3%; 65/222), 'Drugs Excluded in PhIS' (1.4%; 3/222), 'Drug Form' (0.9%; 2/222), 'Drug Name Not in Paper Prescription' (0.5%; 1/222) and other category (3.2%; 7/222). 'Drug Supply Period' had the highest number of discrepancy types (16.8%; 52/310), followed by 'Frequency' (16.5%; 51/310).

CONCLUSION

We identified 32.3% discrepancies and small percentages of incomplete (N=4/12) and inaccurate (N=10/12) data items of PhIS prescriptions. Incomplete and inaccurate prescription data in PhIS hinder its potential as a main reference for formulating policies or clinical processes in patient treatment. The data quality findings and recommended mitigation measures can guide pharmacies in improving practices for prescription data entry in PhIS to ensure high-quality patient medication lists. The findings answered the research questions related to the quality of prescription data in PhIS. Incomplete and inaccurate data remain an important research agenda for healthcare data quality and enhanced patient care and safety.

REFERENCES

- Bülow, C., Noergaard, J. D. S. V., Færch, K. U., et al. 2021. Causes of discrepancies between medications listed in the national electronic prescribing system and patients' actual use of medications, *Basic and Clinical Pharmacology and Toxicology* 129, No. 3 (2021): 221–231.
- Caleres, G., Modig, S., Midlöv, P., et al. 2020. Medication discrepancies in discharge summaries and associated risk factors for elderly patients with many drugs, *Drugs – Real World Outcomes* 7, No. 1 (2020): 53–62.
- Chen, H., Hailey, D., Wang, N., & Yu, P. 2014. A review of data quality assessment methods for public health information systems, *International Journal of Environmental Research and Public Health* 11, No. 5 (2014): 5170–5207.
- Elliott, R. A., Taylor, S. E., Koo, S. M. K., et al. 2023. Accuracy of medication histories derived from an Australian cloud-based repository of prescribed and dispensed medication records, *Internal Medicine Journal* 53, No. 6 (2023): 1002–1009.
- Gates, P. J., Hardie, R.-A., Raban, M. Z., et al. 2021. How effective are electronic medication systems in reducing medication error rates and associated harm among hospital inpatients? A systematic review and meta-analysis, *Journal of the American Medical Informatics Association* 28, No. 1 (2021): 167–176.
- Getachew, N., Erkalo, B., & Garedew, M. G. 2022. Data quality and associated factors in the health management information system at health centers in Shashogo district, Hadiya zone, southern Ethiopia, 2021, *BMC Medical Informatics and Decision Making* 22 (2022): 154.
- Lewis, A. E., Weiskopf, N., Abrams, Z. B., et al. 2023. Electronic health record data quality assessment and tools: A systematic review, *Journal of the American Medical Informatics Association* 30, No. 10 (2023): 1730–1740.
- Lim, Y. M. F., Yusof, M., & Sivasampu, S. 2018. Assessing primary care data quality, *International Journal of Health Care Quality Assurance* 31, No. 3 (2018): 203–213.
- Modig, S., Caleres, G., Nymberg, V. M., et al. 2022. Assessment of medication discrepancies with point prevalence measurement: How accurate are the medication lists for Swedish patients?, *Drugs & Therapy Perspectives* 38 (2022): 185–193.
- Mohammed, S. A., & Yusof, M. M. 2013. Towards an evaluation framework for information quality management (IQM) practices for health information systems – Evaluation criteria for effective IQM practices, *Journal of Evaluation in Clinical Practice* 19, No. 2 (2013): 379–387.
- Ni, Y., Lingren, T., Huth, H., et al. 2020. Integrating and evaluating the data quality and utility of smart pump information in detecting medication administration errors: Evaluation study, *JMIR Medical Informatics* 8, No. 9 (2020): e19774.

- Ozonze, O., Scott, P. J., & Hopgood, A. A. 2023. Automating electronic health record data quality assessment, *Journal of Medical Systems* 47, No. 1 (2023): 23.
- Putra, Y., & Yusof, M. M. 2021. A lean approach to evaluating prescribing errors in medication reconciliation, *Studies in Health Technology and Informatics* 281 (2021): 814–815.
- Rohani, N., & Yusof, M. M. 2023. Unintended consequences of pharmacy information systems: A case study, *International Journal of Medical Informatics* 170 (2023): 104958.
- Syed, R., Eden, R., Makasi, T., et al. 2023. Digital health data quality issues: Systematic review, *Journal of Medical Internet Research* 25 (2023): e42615.
- Uwase, M., Iradukunda, J. D. D., Rusa, D. U., et al. 2023. Towards improving data quality in electronic medical records: An investigation of data completeness in a tertiary hospital in Rwanda, *Studies in Health Technology and Informatics* 305 (2023): 390–393.
- Wang, R. Y., & Strong, D. M. 1996. Beyond accuracy: What data quality means to data consumers, *Journal of Management Information Systems* 12 (1996): 5–33.
- WHO. 2023. *Data Quality Review: A Toolkit for Facility Data Quality Assessment. Module 1. Framework and Metrics*. Geneva: World Health Organization.