Towards Improving Data Quality in Electronic Medical Records: An Investigation of Data Completeness in a Tertiary Hospital in Rwanda

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Abstract. Data quality is a primary barrier to using electronic medical records (EMR) data for clinical and research purposes. Although EMR has been in use for a long time in LMICs, its data has been seldomly used. This study aimed to assess the completeness of demographic and clinical data in a tertiary hospital in Rwanda. We conducted a cross-sectional study and assessed 92,153 patient data recorded in EMR from October 1st to December 31st, 2022. The findings indicated that over 92% of social demographic data elements were complete, and the completeness of clinical data elements ranged from 27% to 89%. The completeness of data varied markedly by departments. We recommend an exploratory study to understand further reasons associated with the completeness of data in clinical departments.

Keywords. EMR, Data quality, Data completeness, Data use

1. Introduction

The use and adoption of EMR have doubled since 2008 worldwide [1]. It has been due to the advancement of Information and Communication Technology (ICT) in general and, more specifically, in the healthcare system for the past 20 years [2]. There are more EMRs developed and implemented worldwide [3]. Most healthcare facilities worldwide have adopted EMR systems to improve the quality of healthcare processes, clinical outcomes, data, and productivity [4]. The World Health Organization's digital strategy aspires to improve digital health system implementation and advocates for a people-centered system [5].

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Two open sources of EMR systems are predominantly used in Rwanda's public health facilities, namely OpenMRS and Open Clinic [6] used in most tertiary hospitals in Rwanda. The broad adoption and use of EMRs have the potential to reuse data in clinical research, but it is still limited in the data structure, completeness, and quality [7,8]. The first step to data quality in EMR is the completeness of data elements in EMR [9]. Other aspects of data quality included accuracy, concordance, plausibility, and currency [10]. To our knowledge, evidence is scarce on the quality of EMRs data in Rwanda. Therefore, this study aimed to determine the completeness of electronic medical records data at a tertiary hospital in Rwanda.

2. Methods

This cross-sectional study used data from 92,153 anonymized individual patients who visited the hospital between October 1st and December 31st, 2022. We extracted data elements, including patients' demographics (age, gender, residence, insurance) and clinical-related information (diagnosis, visit type, department, patient outcome) from Open Clinic. We assessed data completeness and checked whether the above data items were recorded in EMRs. We used descriptive statistics to analyze the complete versus missing data and stratified completeness by each department separately. Stata V15 was used to carry out all analyses. We used anonymized data to improve data quality in the hospital EMRs database; therefore, no ethical approval was sought.

3. Results

The findings of this study revealed that among 92,123 patients' records, data completeness was above 92% in most socio-demographic variables (i.e., gender, age, residence, and insurance). In contrast, clinical variables (i.e., diagnosis, patient outcome) data completeness ranged from 27% to 89%. Subgroup analysis by the type of visit indicated no difference in data completeness for outpatient and inpatient departments.

Table 1. Completeness of eight variables in EMR Records. N= 92,153

Variable name	Completeness in EMR N (%)
Gender	92135 (99.98)
Age	92132 (99.98)
District	92001 (99.84)
Insurer	85679 (92.97)
Type of visit	92153 (100)
Department	92153 (100)
Diagnosis	25649 (27.83)
Patient Outcome	82897 (89.96)

The completeness of the assessed variables by each department showed that data completeness ranged from 27.8% to 100% throughout all departments. There was an increased decline in the percentage of data completeness for diagnoses recorded in EMR in the surgical, internal medicine, and emergency departments. Internal medicine and emergency departments showed a decreased rate of data completeness across all variables compared to other departments.

Table 2. Completeness of the assessed variables by departments. N= 92,153.

Variable name	Department					
	Pediatrics N(%)	Surgery N(%)	Obs&Gyn N(%)	Internal Med N(%)	Emergency N(%)	Others N(%)
Gender	5017(100)	16266(99.9)	7983(100)	4701(99.9)	4608(100)	53560(99.9)
Age	5016(99.9)	16267(99.9)	7979(99.9)	4699(99.9)	4607(99.9)	53564(99.9)
District	5011(99.8)	16252(99.8)	7974(99.8)	4696(99.8)	4604(99.9)	53464(99.8)
Insurer	4569(91.0)	15391(94.5)	7441(93.2)	3915(83.2)	4286(93.0)	50077(93.4)
Diagnosis	942(18.7)	1670(10.2)	3433(43)	264(5.6)	168(3.6)	19172(35.7)
Patient Outcome	4799(95.6)	15074(92.6)	7179(89.9)	3782(80.4)	4111(89.2)	47952(89.5)

*Others has (Pharmacy, laboratory, physiotherapy, dermatology, mental health, neurology, ophthalmology, ENT, anesthesia, stomatology, radiology, and nutrition departments).

4. Discussion

The high rate of completeness for socio-demographic data might be attributed to the fact that they are entered in EMR only by non-clinicians personnel. In contrast, clinical data are recorded in EMR and paper records by clinicians responsible for giving care in addition to data entry. These findings may not be surprising as it has been documented in previous studies [11,12]. During our analysis, we found that there are technical errors, which hinder the quality of data entered in EMR at this tertiary hospital. There were a lot of outliers in the patient's age and typing errors in the way the patient's gender is recorded in the EMR, which indicated that there are errors in data entry or coding in the EMR system, which warrants further investigation. The disease classification systems used at this hospital are not harmonized or updated, hindering the quality of clinical diagnosis-related data entered in the EMR. Data completeness by each department revealed that socio-demographic and clinical data are recorded at the same rate except for internal medicine and emergency departments. A further exploratory study is needed to determine factors associated with a high data-missing rate in those departments.

5. Conclusion

To the best of our knowledge, this is one of the few studies that assessed data quality, particularly data completeness, in a tertiary hospital in Rwanda. The study has found high data completeness in social demographic variables. Improvements in data completeness are needed focusing on clinical data that indicated a low level of completeness. To achieve the optimum level of data quality, healthcare providers, policymakers, and researchers should collaborate to develop effective strategies to improve data quality in EMR systems, such as enhancing data entry protocols, implementing more rigorous data validation processes, and investing in data quality assurance programs. This would probably boost the use of quality data for clinical and research purposes. Future studies may explore factors affecting data quality from healthcare providers' perspectives.

One limitation of this study is that not all data elements were included, as we focused on what we deemed to be the most important ones. Additionally, due to the study's retrospective nature and our use of secondary data, we could only assess one dimension of data quality.

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