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Integration of International Classification of Diseases Version 11 Application Program Interface (API) in the Rwandan Electronic Medical Records (openMRS): Findings from Two District Hospitals in Rwanda

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Abstract. World Health Organisation (WHO) has updated the International Classification of Diseases to version 11 (ICD-11) which was recently adopted for use by countries in 2019. ICD-11 can be used in Electronic Medical Records (EMR) systems with support of extended technologies like Application Program Interface (API). Integration of ICD-11 in Rwandan EMR (OpenMRS) in two health facilities was conducted in July-October 2019. Findings indicated that adapting ICD11-API in EMR is feasible. More than 50% of diagnoses were recorded using ICD-11. Healthcare providers perceived ICD-11 API as easy to learn and useful for harmonization of diagnosis, data reporting and insurance reimbursement. Integration of ICD-11 API in EMR can be scaled up to all hospitals for use in Rwanda and other countries using similar system.

Keywords. Clinical informatics, Electronic Medical Records, ICD-11 API, OpenMRS

1. Introduction

The World Health Organization (WHO) established International classification of Diseases (ICD) comprising mortality and morbidity way back in 1948 and published version six of ICD [1]. The current 11th version of International Classification of Diseases (ICD-11) is the standardized method for recording, reporting, analysis, interpretation and

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comparison of morbidity and mortality data [2]. The ICD-11 was released in 2018 and endorsed by member states in May 2019 in the 72nd general assembly [1]. ICD defines the nature of diseases, disorders, injuries and other related health problems, listed in a broad, ordered fashion granting an easy retrieval. A previous version of ICD was widely used with importance in different disciplines such as dentistry, internal medicines, psychiatry and reimbursements [3-5]. Healthcare systems have extensively used Electronic Medical Records (EMR) system to improve care, research and programmatic decision-making [6]. The use of Electronic Medical Records (EMR) system in healthcare has lacked use of standard classifications to enhance interoperability and effective use of routine data collected in EMR [7]. When data is collected using standard methods, it allows use of data for care of patients and decision-making as well as research [8]. The need for use of ICD-11 in EMR has called the WHO to develop an Application program interface that allows integration and access of ICD-11 classification in respective EMR [8]. In Rwanda, ICD-11 API was integrated in the Rwandan EMR (OpenMRS) [9] using docker technology [10]. The aim of this article is to describe the process of integration and explore how ICD-11 was used to record diagnosis in early implementation within two district hospitals.

2. Methods

We used an iterative development that applied four different methods: idea generation and prototyping, non-participatory observations, user test interviews, and descriptive analysis of codes diagnosis used in EMR. We first described the process of i**dea generation**, including challenges and related approaches for integration of ICD-11 into the EMR system**;** The research team who authored this paper brainstormed on how ICD-11-API can be integrated in Rwandan EMR and deployed it in Masaka and Muhima district hospitals chosen conveniently. Activities of integration were done in two successive weeks and the team agreed on the approach to integrate ICD-11 API in Rwandan EMR. **Non-participatory observations;** At least two researchers observed during clinic hours how clinicians used ICD-11 API in EMR to record diagnosis after implementation. **User test interviews;** we interviewed clinicians to share their perceptions regarding usage of ICD-11 API in EMR. A semi structured interview guide was used to interview doctors and paramedical staff who used EMR at least 2 weeks after installation of ICD-11 API at two hospitals. Interviews were conducted in a private room at the clinic with one researcher interviewing and another taking notes and recording. Recorded interviews were transcribed and analyzed using informed grounded approach. **Descriptive analysis of coded diagnosis in EMR;** researchers extracted EMR databases of two district hospitals within 3 weeks post implementation of ICD-11 API and using descriptive statistics analyzed how clinicians captured diagnoses. The study sought ethical approval from University of Rwanda College of Medicine and Health Sciences Institutional Review Board (CMHS-IRB) No.378/CMHS IRB/2019.

3. Results and Discussion

The integration process of ICD-11 API into OpenMRS involved **idea generation;** researchers brainstormed on how to integrate ICD-11 API in EMR. They carefully reviewed the technical development of ICD-11 guided by WHO team who developed

ICD-11 API. Research team also reviewed EMR system used in two hospitals. Guided by national developers of OpenMRS, they reviewed how EMR could use ICD-11 API. Two scenarios were suggested; first was to copy all codes and have them as diagnosis concepts in EMR. This required minimal time, but end users could lose search functionality of ICD-11-API. Second ICD-11 API could be integrated using docker container technology, which was installed on a local server of the OpenMRS instance and was accessed through OpenMRS HTML form using embedded coding tool for web API and the updated concepts dictionary to operate with OpenMRS framework. The second approach was adopted which allowed clinicians to use search functionality. After integration on test server, the same package was replicated in two district hospitals chosen purposively after accepting to test the ICD-11 API. An IT technician at the district hospital was trained on how to guide clinicians to use new ICD-11 API features added in EMR. **Non-participatory observations;** At least two researchers observed how clinicians use ICD-11 API during clinic hours. Users were familiar with search and coding patient diagnosis in EMR with minimal guidance at first time. In general, assigning a diagnosis to a patient using ICD-1API took very few seconds from 15 to 30. Observation found that some users were struggling to get to ICD-11 searching tool due to network problems (internal network) and forgetting to locate the ICD-11 icon in EMR for them to search and save a diagnosis. Some clinicians were struggling to assign a diagnosis, which match details of the country protocols and reporting requirement from the Ministry of Health. **User test interviews;** Participants interviewed in two hospitals were medical doctors (2), physiotherapists (2), ophthalmologists (1), and dental therapist (1) who used ICD-11 API as a searching functionality for coding patient diagnosis in EMR during visit. In general, all users interviewed felt it very easy to start using ICD-11 API, they could access ICD-11 search tool any time they wanted and could easily find diagnosis required for each patient received and help to record specific diagnosis. *"I can say that this search tool is really good and helped us to code diseases more accurately than before [……] example we could record cataract in general but cataract can be caused by aging and cataract caused by trauma but ICD-API can describe it easily and is very easy to learn"* ***P0201****. "You see because we are using electronic system, ICD-11 API is useful because it lists all diagnosis and you have to select diagnosis for the patient that you have. It is very easy to learn and [….] no challenge faced to classify diseases"* ***P0102.*** Users reported that ICD-11 is useful in the hospital because it helps to code standard diagnosis so that everyone does it the same way. They also reported that they desired ICD-11 API in EMR because it helps standard coding of diagnosis, reporting of patient data and reimbursement from health insurances and they fully understand all ICD-11 content. *"It helps standard diagnosis and helps reporting structured data […] I can say that it is trusted and other hospitals can use it, it is fit for clinicians, hospital reimbursement from insurances"* ***P0101****.* However, some access challenges were related to poor network for some hours in one hospital and hard to locate where to get diagnosis in EMR at first time of use. *"The challenge I faced is that during orientation I was not around, and I could not recall clicking on the correct button to get where to pick ICD-11diagnosis but after asking I could get diagnosis needed."* ***P0103.*** **Descriptive analysis of coded diagnosis in EMR;** At Masaka hospital, we found a total of 227 diagnoses were recorded in EMR within 15 days post implementation of ICD-11 API. Among 227 diagnosis recorded, 134 (59.1%) were recorded using ICD-11 API by healthcare providers. Healthcare providers who coded ICD-11 include medical doctors (74.4%), paramedical i.e. dental, ophthalmology and physiotherapists (69.8%) and medical doctor specialists (16.3%). On the other hand, at Muhima hospital, 655 diagnoses were recorded within 7 days post implementation of ICD-11 API. Of all diagnoses recorded within 7 days, 353 (53.9%) were captured using ICD-11 API. General practitioners coded 48.3% of their entries, medical doctor specialists recorded 53.3% of their entries and paramedical 91.5% of their

entries using ICD-11 API. This paper described the early integration of ICD-11 API in Rwandan Electronic Medical Records (OpenMRS). Methods of user centered design [11,12], qualitative [13] and quantitate analyses were used to explore how best ICD-11 API can be integrated and used by clinicians. These different methods helped to triangulate results for exploring barriers and facilitators to integrate and use ICD-11 API in local EMR. Working in a multidisciplinary team including ICD experts, EMR experts, and implementers' experts contributed to the effective integration of ICD-11 API that was felt useful by hospital personnel. The nature of ICD-11 API with search functionality tool helped clinicians to record diagnosis in EMR with minimal barriers at the beginning. Within three weeks of integration of ICD-11 API in EMR, over 50% of diagnosis were captured using ICD-11 API. This implies that some clinicians were still using ICD-10 in early phase of integration. By explaining the use of ICD-11 API to all clinicians and deactivating ICD-10 link in EMR may increase diagnosis capture at a rate of 100%.

4. Conclusions

In general, integration of ICD-11 API in the Rwandan Electronic Medical Records (EMR-OpenMRS) was feasible with efforts of EMR implementation researchers, IT developers, and WHO experts in ICD-11. We learnt that it is useful to standardise how diagnoses will be recorded to ensure their usability for clinical purposes, data reporting and insurance reimbursement. Integration of ICD-11 API in EMR can be scaled up to all hospitals for use in Rwanda and other countries using similar system.

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