

C S Pramesh et al.

Electronic medical records initiative, India

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National Cancer Grid initiative on electronic medical records, India

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Abstract

Problem Inefficient workflows, incomplete data and lack of interoperability can hinder the uptake of electronic records systems, challenges particularly relevant in cancer treatment with its complex longitudinal and multidisciplinary nature. Further, products developed in high-income countries are not designed for compatibility with the workflows of low- and middle-income countries, which face additional issues of cost.

Approach We evaluated centres with different resources and geographical locations to develop the requirements of our product. We published an invitation to potential vendors, evaluated submitted product development bids and enlisted six

vendors. Our subcommittees developed workflow modules and templates, ensured interoperability and developed key performance indicators.

Setting The National Cancer Grid, a network of more than 360 cancer centres in India, assembled a team of experienced oncologists and digital health experts to develop electronic medical records products with specialized oncology capabilities.

Relevant changes Our collaboration between clinical and technical experts led to the development of six new, high-quality and interoperable products, compliant with the varying needs and resources of hospitals. We supported more than 20 centres with procurement and adoption through partial funding and technical assistance.

Lessons learnt In developing product requirements, we gained an understanding of the challenges faced by hospitals in implementing such systems; by inviting vendors to submit a product development bid, we ensured that the product development cost was borne by the vendor and not hospitals; and by monitoring user feedback, we can continue to address issues raised by health workers and encourage the adoption of electronic medical records.

Introduction

The implementation of well-designed electronic medical records can enhance the delivery of high-quality care and improve patient outcomes through better documentation, adherence to evidence-based treatment guidelines, reduction in medication errors and improved communication between health workers.¹ Cancer treatment, with its complex longitudinal and multidisciplinary nature across the continuum from diagnosis to multimodality treatment and survivorship, requires reliable documentation that is accessible to all stakeholders; electronic medical records are therefore even more relevant in oncology.² Data from electronic records can also enable real-world studies and facilitate quality improvement in cancer treatment.³

The benefits of electronic medical records in oncology can however remain elusive because of inefficient workflows, design and interface issues, incomplete data availability, difficulties with data retrieval and, importantly, a lack of interoperability,⁴ even in high-income countries. While some initiatives have worked towards addressing these challenges, the implementation of electronic records remains limited.⁵

The role of electronic records in contributing to the delivery of high-quality care is even more important in low- and middle-income countries, which have fewer resources and a smaller workforce compared with high-income countries.⁶ However, existing electronic medical records solutions developed in high-income countries (i) are expensive, (ii) require considerable investment in infrastructure, training and time from already overworked clinicians and (iii) do not reflect the process flows of low- and middle-income countries, limiting their adoption.^{7,8} Therefore, affordable solutions that consider workflows, resource

availability, interoperability and simple data capture are needed for low- and middle-income countries to benefit from electronic records.

We describe our initiative to develop and deploy electronic medical records products applicable in both small and large hospitals, and that benefit all stakeholders without duplication of efforts in data collection or extraction. Our initiative aims to provide data ownership to patients; enhance the efficiency of clinicians and reduce the risk of errors in care; enable the monitoring of quality of care; and facilitate seamless, decentralized and evidence-based cancer care.

Setting

The National Cancer Grid, a network of more than 360 cancer centres and institutes across India, was established to ensure equitable cancer care in India.⁹ Approximately 850 000 new cancer cases (60% of the 1.4 million new cancer cases in India annually, according to unpublished National Cancer Grid data) are treated annually across the member centres. In a 2022 survey of member organizations to identify the requirements of oncologists in the adoption of digital technology to enhance cancer care, 80% of those who responded (81/101) prioritized electronic medical records. Under the guidance of the Koita Centre of Digital Oncology,¹⁰ the National Cancer Grid has therefore been focusing on the development and adoption of user-friendly, interoperable electronic records products that meet the digital health standards developed by the Ayushman Bharat Digital Mission.¹¹ The key elements of such products include the automation of workflows, standardized data capture, strong data security and protection features, compliance with the digital data protection act and consent-based health information exchange.

Approach

Fig 1. shows the development and deployment phases of the project.

Development of requirements

To define the requirements of electronic medical records products in oncology, we collated information on potential areas for improvement from customer reviews and user feedback. Our core team of experienced oncologists from National Cancer Grid centres with an understanding of digital technology, as well as technical experts with experience in digital health solutions, developed these requirements. Our team evaluated representative centres from different geographical regions and with different levels of resources to understand the varying process workflows, availability of technology support and existing hospital

management information system (if any). We then performed a gap assessment to identify the organizational requirements for electronic medical records deployment. The draft requirements were augmented with the results of an informal literature search.^{12–14}

Our identified requirements were categorized as either functional (general capabilities, oncology-specific requirements and oncology-specific enhancements) and non-functional (interoperability, security and data privacy). Our team of experts reviewed the initial list of 253 requirements and prioritized 142 items as the most relevant. To account for variations in the needs and resources of the centres, the requirements were categorized as either silver (core requirements), gold (enhanced features) or platinum (advanced features with artificial intelligence tools). These prioritized and categorized requirements were further refined using input from industry experts, electronic records vendors and technical experts in digital health initiatives. Subsequent validation involved interviews with clinicians and health information technology teams from hospitals that had responded to the May 2022 survey, and a virtual workshop delivered by the Koita Centre of Digital Oncology to National Cancer Grid members and information technology and digital health experts. Our final 216 requirements (162 functional and 54 non-functional) are listed in the online repository.¹⁵ The inclusion of 82 general requirements and their alignment with the digital health standards¹⁶ published by the National Accreditation Board of Hospitals and Health care Providers, India, facilitates the implementation of electronic records products in centres that also treat patients with diseases other than cancer.

Vendor selection

We published an invitation to potential suppliers and evaluated submitted bids through a three-step process: prequalification, technical evaluation including product demonstration and financial evaluation. We received bids from 17 vendors, shortlisted 13 and enlisted six different vendors to create electronic medical records products (online repository).¹⁵ We selected six vendors rather than a single vendor to develop these products to enable competition and better pricing, and to minimize the risk of failure. All selected vendors agreed to follow our developed requirements and the guidelines of the Ayushman Bharat Digital Mission,¹¹ adhere to the development timeframe of 18 months, use relevant clinical standards for interoperability, comply with security and data privacy, and provide training and support.

Modules and templates

We collated existing best practices and workflows from multiple National Cancer Grid centres, and created draft modules and templates for the different sections of the electronic medical records (e.g. multidisciplinary clinics, staging, oncology specialities, cancer site and subsite, and palliative care). We finalized these modules and templates through an iterative process based on inputs from the core team, various clinical subcommittees (to ensure alignment between modules) and an open stakeholder consultation. Our objective was to develop modules that capture the clinical workflow intuitively, reduce the time spent on documentation and present information in chronological order to assist clinical decision-making.

Interoperability

A subcommittee comprising core team members, digital health experts and selected vendors created a blueprint to facilitate interoperability, which will be published as digital public goods after pilot testing. The key components included the development of a data dictionary, the identification of relevant data variables for information exchange, the coding of variables following the industry standard Fast Health care Interoperability Resources rules and specifications, and the validation of interoperability.

Key performance indicators

Our core team and other experts evaluated and finalized a list of key performance indicators identified from the literature. These indicators will be available as summary data and dashboards to relevant stakeholders for quality monitoring and improvement. The methods by which these indicators are measured are described at the relevant data fields.

Procurement and adoption

To achieve the benefits of our developed electronic medical records products, it is essential to support centres in selecting an appropriate product according to their requirements and resources. To facilitate adoption across centres, our team of technical and digital health experts initiated an assistance programme by assessing centre readiness in terms of leadership commitment and required investment in infrastructure enhancement for product deployment. Our procurement and adoption programme involves technical assistance with selection of the most suitable product, mediating interactions with vendors for product demonstration and negotiating price, and partial funding (applicable for only public and charitable hospitals).

We sourced the funding for procurement and adoption through corporate social responsibility grants (online repository).¹⁵

Relevant changes

Before inviting vendors to submit a product development bid to develop a new electronic medical records product, we invested much time and effort into developing specific requirements.

Our collaboration between multidomain experts and vendors led to the establishment of six new, high-quality and interoperable products, compliant with the varying needs and resources of hospitals.

To ensure the implementation of these new products, we supported 20 centres with the procurement and adoption of an electronic medical records product through partial funding and technical assistance.

Lessons learnt

Box 1 provide a summary of the main lessons learnt during the development and deployment of six different electronic medical records systems.

In developing comprehensive electronic medical records product requirements, we gained an understanding of the challenges faced by hospitals and vendors because of a lack of technical or clinical expertise, respectively. By considering the varying requirements of hospitals with different levels of resources, we have ensured that our initiative can be replicated in other countries. By making these requirements available as digital public goods, we hope to contribute to the improvement in quality of electronic records solutions worldwide.

By inviting vendors to submit a product development bid, we ensured that the cost of product development was borne by digital health solutions companies. By awarding six different vendors with a contract, we benefited National Cancer Grid centres (and therefore patients) by ensuring fair pricing and competition; vendors will have access to the large market of hospitals currently without an electronic medical records system.

We are aware of resistance to these new systems by clinicians who find it difficult to allocate time for data documentation. To address this problem, we are testing artificial intelligence solutions to digitize health records without the need for manual data entry, avoiding disruptions to interactions between patients and health workers. Other future

changes include monitoring the implementation of the electronic medical records products and incorporating user feedback; developing clinical decision support systems and integrating these with electronic records; and using deidentified digital data to enhance cancer registries and promote research.

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Competing interests:

None declared.

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Box 1. Summary of main lessons learnt

- In developing comprehensive electronic medical records product requirements, we gained an appreciation of multisectoral collaboration and an understanding of the challenges faced by hospitals in implementing such systems.
- By inviting vendors to submit a product development bid, we ensured that the cost of product development was borne by the digital health companies; by working with more than one vendor, we ensured that health centres and patients benefited from competition.
- By monitoring the implementation of the electronic medical records products and incorporating user feedback, we are addressing issues raised by health workers and encouraging adoption of the products.

Fig. 1. Stages of the development and deployment of electronic medical records by the National Cancer Grid, India

