Playbook - Paper to eMR Implementation

Contents

Version control

Version	Date	Main changes
1.0	December 2024	First version

What is this?

This is the paper to eMR playbook on the CTC.Africa website (https://www.ctc.africa/) that provides general information on eMR and the evolution and experiences of eMR implementation on the African continent. The playbook offers a thought process for clinical sites to assess the potential value of an eMR implementation for their site and key considerations for successful and sustainable implementation based on experiences from African sites.
It was developed by the CTCAN initiative (https://www.ctcan.africa/) for the CTC.Africa website.

Abbreviations

eHR – Electronic Health Records

eMR – Electronic Medical Records

SSA – Sub-Saharan Africa

Key terms & concepts used in the Playbook

eMR - Electronic Medical Records (eMRs) are computerized versions of paper medical records. They contain detailed patient information such as medical history, diagnosis, prescriptions, treatment plans, test findings, and other details.

Interoperability is the ability to move information easily between people, organizations, and systems. It enables a connected healthcare system that shares health information securely, safely and without any special effort from the people and organizations involved.

Steppingstone *in the context of this playbook -* Steppingstone for a site for the eMR implementation is defined as the opportunity that serves a transitional step to implement an eMR solution.

Digital common good is a concept that refers to the idea of using digital technology for the benefit of society and the environment. It is based on the principles of equity, democracy, sustainability, and participation in the digital sphere. Digital common goods are shared resources that anyone can access, use, and contribute to, such as open-source software, open data, open access publications, and online communities. Open-source software (OSS) is computer software that is released under a license in which the copyright holder grants users the rights to use, study, change, and distribute the software and its source code to anyone and for any purpose. The WHO has published their Global Strategy on Digital Health 2020–2025 to support the implementation of digital health tools and encourage the use of digital technologies based on a common framework to accelerate global attainment of health. It highlights a need for ensuring these tools are ethical, secure, equitable, and sustainable with development being conducted with data principles in mind (transparency, accessibility, scalability, replicability, interoperability, privacy, security, and confidentiality). (WHO, WHO: global strategy on digital health 202-2025, 2021) (https://iris.who.int/handle/10665/344249)

Design thinking is a human-centered, problem-solving approach that emphasizes understanding the needs, experiences, and perspectives of users. It involves an iterative process that typically includes the following stages:

1. **Empathize**: Gaining a deep understanding of the user's needs and challenges through observation and engagement.

2. **Define**: Clearly articulating the problem to be solved based on insights gathered in the empathize phase.

3. **Ideate**: Generating a wide range of ideas and potential solutions through brainstorming and creative thinking.

4. **Prototype**: Creating tangible representations of ideas to explore their feasibility and gather feedback.

5. **Test**: Evaluating the prototypes with users, gathering feedback, and refining the solutions based on this input.

The design thinking process is iterative, meaning that teams often revisit previous stages based on what they learn, allowing for continuous improvement and innovation. (Five stages of design thinking, according to the Hasso Plattner Institute of Design at Stanford , n.d.)

1. Introduction, what, why and history

Launching a strategy on digital health has been and is more than ever at the forefront of global, regional, and national health organizations with the ultimate goal to provide universal health coverage for all. Strategies are published by WHO (Global strategy on digital health 2020-2025 (WHO, WHO: global strategy on digital health 202-2025, 2021) Africa CDC (Africa CDC - digital transformation strategy, 2023) and part of the UN Sustainability Development Goal 3 (United Nations SDG goal 3, n.d.)

On country level, there might be various rules, regulations and guidelines set by government authorities and healthcare organizations.

Such a top-down strategy should be complemented with a bottom-up approach enabling sites to plan and execute their **own digital pathway** that fits into the larger scheme but with a tailor-made trajectory that addresses the local challenges and increases the efficacy and efficiency of care in a stepwise approach.

Where to start on such a digitalization trajectory and how to ensure this is affordable and sustainable over time? How to ensure this digital journey fits into the overall site's strategy and an aligned vision is achieved? How to motivate the site staff going through this change? What value will it drive for the patient, the doctor, the receptionist, and others? A lot of questions to consider before advancing with such a digital implementation project.

Therefor this Playbook was designed with the intent to **provide relevant materials and pose the right questions**, scoping out the issue and its relevance that would guide your creative thinking to design your own site specific digital strategic plan to transform form paper based to electronic records, as there is no one size fits all in implementing a digital strategy. In addition, the Playbook contains learnings and stories from local digital implementations and practical tips to implement electronic medical records at a site. A successful eMR implementation in the context of digital transformation requires a holistic approach, involving not only technology but also people, processes, and policies. The Playbook is written from a site perspective, with input from clinicians and input from technical functions.

For more information on the data sharing between the multiple health centers, we kindly refer you to the CTCAN data sharing roadmap named, '**Developing a federated data sharing network across multiple health care centers'.**

What

What are electronic Medical Records (eMR) and what is the difference with electronic health records (eHR)?

Healthcare organizations are abandoning their traditional ways by transitioning from paper to electronic medical records (**eMR**). An eMR is described as an electronic record of a patient's health-related information regarding a single healthcare organization. Depending on the software and the site's patient journey, eMR replaces or collaborates with the traditional method of charting on paper.

eMRs have advantages over paper records, such as tracking data over time, easily identifying which patients are due for preventive screenings or checkups, checking how their patients are doing on certain parameters, and monitoring and improving overall quality of care within the practice.

The difference between eMR and **eHR** (electronic health records) lies in the eHR ability to share information with other practices, so for example patient history and other useful data can be accessed anywhere and anytime. For example, let's say a patient has gone to the same clinic for years and suddenly must make a change for whatever reason; their medical history can be transferred to another practice. Rather than starting from scratch, a healthcare provider will instead be able to access information from all clinicians involved in the patient's prior treatment. Essentially, an eHR is an eMR, just with more functionality, or interoperability.

Why

Why should a site or hospital be considering transitioning your paper data to an eMR system?

Some of the advantages are listed below:

- To start with, an eMR system would save time and money in your practice. Rather than searching through countless paper files to find a specific medical record, appropriate site users can quickly and easily access a patient's history online facilitating decision taking. For clinical sites, an eMR can help with the cost-effectiveness of a clinical trial and in patient care in general.
- An eMR can provide better security of confidential and sensitive records. Certain users can be given different levels of accessibility to patient information to assure confidential files are kept secure.
- Not only does eMR provide benefits for your practice, but it also does the same for your patients. By avoiding the errors that come with handwritten medical records, more accurate diagnosis and treatment can be given to ensure patient safety.
- eMR software can also allow for quick and easy transferring of individual records between hospitals, pharmacies, and labs. Ensuring that eMR systems are interoperable with other healthcare systems and data exchange standards is essential for efficient healthcare information sharing. eMRs can help sites that are interested in conducting (more) clinical studies, by increasing the visibility on patient population in their site.

These are examples of how an eMR implementation at a site can have added value for the patients, research and the overall public health. (Evan, 2024)

https://www.selecthub.com/medical-software/emr/transition-paper-to-emr/

The reasons will become even more clear reading the success stories of the sites that have implemented an eMR and to understand what a steppingstone in the digital transformation journey can be. On a longer term, clinical site or hospitals with their data digitalized will have an advantage over paper-based sites when it comes to optimizing patient recruitment and site selection for clinical studies and sharing of data with other hospitals. (Syzdykova A., 2017)

https://pubmed.ncbi.nlm.nih.gov/29133283/

History of eMR implementation in SSA

The implementation of electronic medical records (eMRs) in Sub-Saharan Africa (SSA) has been a gradual process that has evolved. SSA is a diverse region with varying levels of healthcare infrastructure and resources, so the pace and extent of EMR implementation can vary from one country to another. Here is an overview of the progression of EMR implementation in SSA over time:

Early Adoption (2000s-2010s):

- In the early 2000s and 2010s, some countries in SSA began experimenting with EMRs in a limited capacity.
- Pilot projects and small-scale implementations were initiated in urban hospitals and clinics, often with the support of international organizations and donor funding.
- Challenges included limited access to reliable electricity, internet connectivity, and a lack of trained IT professionals.

Government Initiatives (2010s-Present):

- In the 2010s and continuing into the present, several SSA governments recognized the potential benefits of EMRs for improving healthcare delivery and started implementing national-level EMR systems.
- These initiatives often involve collaboration with international partners and organizations to secure funding, expertise, and technology.
- National eMR systems are being developed to facilitate data sharing, improve healthcare quality, and enhance disease surveillance. Some countries that have made progress in implementing national eMR systems are mentioned here:

> **Tanzania:** The Government of Tanzania, through its Ministry of Health, Community Development, Gender, Elderly and Children (MoHCDGEC), is developing an integrated national health information system (HIS) that includes an electronic medical record (EMR) program.
> **Rwanda**: Rwanda was one of the pioneers in implementing a national eMR system. They launched the Rwanda Health Information Exchange (RHIE) to facilitate the sharing of health information across the country.
> **Kenya**: Kenya had been working on implementing electronic health records (EHRs) and had several initiatives, including the Kenyan Health Information System (KHIS), which aimed to digitize health records across the country.
> **South Africa**: South Africa has been working on the implementation of a national health information system, including electronic health records, to improve healthcare management and service delivery.
> **Ghana**: Ghana was in the process of developing and implementing an electronic health management information system (eHMIS) to improve healthcare data management.
> **Uganda**: Uganda was working on a national eHealth infrastructure to digitize healthcare data and improve health information management.
> **Nigeria**: Nigeria had various initiatives and projects to digitize healthcare records and improve health data management, although the progress was uneven across the country.

Non-Governmental Organizations (NGOs) and International Partners:

- NGOs and international organizations have played a significant role in supporting EMR implementation in SSA through funding, technical assistance, and capacity-building efforts.
- They often work in partnership with local governments and healthcare institutions to strengthen EMR systems and address the associated challenges.

Challenges and Barriers:

- Despite progress, there are significant challenges to eMR implementation in SSA. These include limited funding, infrastructure deficits (such as inconsistent electricity supply), and a shortage of trained healthcare and IT professionals.
- Data privacy and security concerns are also critical, as are concerns about interoperability between different eMR systems.

Role of Mobile Technology:

- Mobile technology has played a pivotal role in healthcare delivery and EMR adoption in SSA.
- Mobile health (mHealth) applications and platforms have been used to collect patient data, monitor health conditions, and facilitate communication between healthcare providers and patients, especially in remote areas.

Progression and Future Outlook:

- The implementation of eMRs in SSA is an ongoing process that varies from country to country. Some countries have made substantial progress in digitizing healthcare records, while others are still in the early stages of adoption.
- The outlook depends on continued investment in healthcare infrastructure, training of healthcare workers, and overcoming the unique challenges faced in the region.

In summary, the implementation of electronic medical records in Sub-Saharan Africa has been a gradual process, with varying levels of progress in different countries. Despite challenges, governments, NGOs, and international partners are working together to advance eMR systems and improve healthcare delivery across the region. The adoption of mobile technology and mHealth solutions has also played a significant role in bridging gaps in healthcare access and data collection.

2. Guiding principles

The guiding principles for implementing an eMR solution at a site or hospital are:

- **Customized for the site's needs** and preferably fitting into the country's national digital strategy allowing reportable data to be more easily reported at national level or beyond,
- **Phased implementation approach** linked to the priorities and business needs of the site,
- **Affordability and sustainability** – use of open-source software/common digital good or a low cost-commercial solution complemented by support at the site,
- **Scalable & future oriented solution,**
- **Interoperability** between institutions and health solutions – key question to answer here is what other systems does the eMR solution need to connect within the hospital and beyond.

Amongst other organizations, WHO, PATH and Africa CDC have created strategies for supporting growth in countries' digital health environment.

WHO – 2012

In 2012, the World Health Organization and the International Telecommunication Union (ITU) identified **seven fundamental eHealth strategy building blocks** for supporting the growth and maintenance of countries' digital health environment. (WHO, National eHealth Strategy Toolkit, 2012)

This WHO Toolkit focusses on 3 aspects: 1. Establishing a National eHealth Vision 2. Developing a National eHealth Action Plan 3. Monitoring and Evaluation.

FIGURE 1
WHO-ITU eHealth strategy building blocks. Source: World Health Organization (WHO), International Telecommunication Union (ITU) (8).

The intent of the current document and the transformation map is to translate the WHO building blocks into tangible steps to go through by the hospitals, including an overview of local partners to work with supporting the implementation of an eMR solution.

In general, implementing a new technological solution in SSA requires a thoughtful and context-specific methodology – there is **no one-size-fits-all approach**.

PATH – 2017

We can refer to the **nine principles of digital development** & use of mature digital solution (PATH, digital square - 2017) - adopted globally and supported by WHO and UN - (Principles for Digital Development, n.d.)

Africa CDC Digital Transformation strategy of Dec 2022

Africa CDC's Digital Transformation Strategy aims to clarify the strategic purpose, prioritize key initiatives, and establish partnerships that will drive the digital transformation efforts to enhance public health and disease control across Africa. (Africa CDC - digital transformation strategy, 2023), (AfricaCDC, 2022) https://africacdc.org/wp-content/uploads/2022/12/Africa-CDC-DTS-Summary-for-CPHIA-3.pdf

https://africacdc.org/download/digital-transformation-strategy/

3. Digital transformation journey

According to the authors of the article, 'How digital transformation can accelerate data use in health systems' (Werner L., 2023)
 https://www.frontiersin.org/journals/public-health/articles/10.3389/fpubh.2023.1106548/full,

 Digital transformation is not a simple, step-by-step process. Rather it is complex and iterative, where many components rely upon or are affected and supported by other components.

The overview below shows where technology can play a role linked to data - starting for example with enrolment data and growing towards compliance data. Where can technology help and what can be the benefits per step – from the Digital Transformation Handbook for primary health care (WHO, Digital transformation handbook for primary health care, 2024)

The implementation of electronic medical records (eMRs) is a process that requires careful planning and execution. According to a study published in BMC Health Services Research (Janssen A, 2021), some of the biggest challenges in implementing EMRs include

- lack of technical support,
- increase workload
- and the learning curve for staff

https://bmchealthservres.biomedcentral.com/articles/10.1186/s12913-020-06015-6.

To ensure a successful implementation, it is important to identify stakeholders and governance, collect client-specific data, conduct site visits, localize system configuration and workflow, coordinate data collection, design, and build "sprints," and document business processes with operational input.

Other factors that can facilitate success include strong organizational support with a visible executive team, well-communicated aims for clinical processes and workflows, early focus on system migration, ensuring adequate infrastructure, support and training, and demonstration of efficiency.

It is also important to evaluate organizational readiness for eMR implementation in terms of culture, leadership, management, technical infrastructure, governance, and operational planning. This can help identify potential gaps in capability system functionality and awareness of important "peripheral" effects such as impacts on communication.

In summary, the biggest learnings from the implementation of eMR include the importance of careful planning and execution, identifying stakeholders and governance, strong organizational support with

a visible executive team, well-communicated aims for clinical processes and workflows, early focus on system migration, ensuring adequate infrastructure, support and training, demonstration of efficiency, evaluation of organizational readiness for eMR implementation in terms of culture, leadership, management, technical infrastructure, governance and operational planning.

4. Steppingstones to implement an eMR solution

What can be a steppingstone for implementing an eMR solution or even an accelerator in the Digital Journey of a site in general:

- A site needs a tool to help in their day-to-day work in the clinical practice, seeing and following up on patients, linked to the work and patient flow at a site,
- A site needs a tool to optimize the follow up of the financial situation, the costs and returns,
- A site needs to implement an eMR solution as a follow up of a country or Ministry of health requirement,
- A site needs a tool to follow up on a certain patient population for their own research – to answer a specific data question,
- A site is learning from sister hospitals that had a use case for implementation (for example new research emerged after digitalization) and it would be beneficial to share data between sister hospitals.

Insights from literature review and publications can help understand the reasons why African sites have implemented an eMR solution, what the challenges are and how to overcome these.

Learnings through country initiatives: Two front-runners in implementation eMR solutions are Tanzania and Kenya.

Publication link	Lessons learned in article
Tanzania_technical_highlight_developing_an eMR system_in_Tanzania (Technical highlight: developing an electronic medical record system in Tanzania, 2019)	During eMR development and implementation, it became evident that standardizing the steps comprising hospital patient case management among health facilities is important for optimal system use. In addition, there needs to be a strong vision from stakeholders, backed by sustainable use cases, prior to development. Finally, EMR implementation is a resource-intensive undertaking. Where resources are limited, the system can be implemented gradually through functional areas to achieve value early.
User's perception on factors contributing to eMRs systems use: a focus group discussion study in healthcare facilities settings in Kenya (Ngugi, 2021)	Facilitators and barriers to eMRs use From the qualitative analysis of the Focused group discussed data, the publishers identified six categories: (1) System functionalities, (2) training, (3) technical support, (4) EMRs operation mode, (5) human factors, and (6) infrastructure.

Fig. 1 Summary of codes and categories, and recommendations that emerged from the content analysis

Data use partnership: digitalizing Tanzania's Health System (Data use partnership: a Tanzanian government-led initiative, n.d.)	The digitalization journey consists of 4 main areas to achieve digital transformation: 1) Strengthening digital governance and policy 2) Building health worker capacity for the future 3) Digitalizing primary health care 4) Coordinating the digital health ecosystem and investments

5. Real life example: digital transformation journey through eyes of clinicians.

From discussions with clinicians who worked in hospitals in Kenia and Rwanda we have gained insights of using paper versus electronic medical records and understand the benefits for patients, health care worker and policy level advantages.

Please note below section are personal opinions and experiences from the clinicians.

Leadership and Governance

What can be the value of data to convince leaders and teams to digitalize data?

Data and evolution of data, trends of diseases for example can be of value for the hospital. Data can be an asset to do research and publish on research, with the intent to attract more research or sponsors/funders - to re-invest into hospital.

How to map the stakeholders of a hospital in the decision of an eMR solution?

To map out stakeholders at the start of a new project, such as an eMR implementation at a site is key with the intent to get buy-in and to make the right decisions. Keeping the stakeholders up to date during the entire process is key as some of them might be your change agents.

Strategy and Investment

How to make sure that the funding mechanism for the digital solution and everything related is sustainable?

The investment into a digital solution should fit into the business model of the hospital as a starting point and ideally there should be a longer-term vision for the implementation and adoption of the digital solution. The leadership of the hospital would ideally have a placeholder for digital solutions into the budget. Initial funding could be provided by an external party (fi. grant or linked to research) but it should remain affordable over time. Costs for paper storage and maintenance will reduce over time. Reduction of time needed to look up data would also account for cost savings.

Where are the efforts from the institutes on digital journey? Is it on your priority list?

This question is linked to the previous question. Where is the eMR solution implementation on the list of priorities for the hospital? What can be steppingstones for the sites in the digital journey, meaning what is the most urgent and important challenge that could be solved or improved by implementing a digital solution. It could be increasing the understanding of your own data linked to research questions or facilitating data reporting out requirements on country level. Other steppingstones for digitalization effort could be related to billing, diagnostic or lab data results overview.

Services and applications

What are the key things to consider when looking to implement a digital solution?

What are the options for storing data? Digital solutions come with the need for IT support. Do you have internal capability that can be leveraged, or will you work with an external vendor to help with the implementation? Does the vendor provide IT support during your team's business hours? Do you consider an open-source digital common good solution versus other possible solutions, what are the pros and cons?

Standards & interoperability

What are thought steps to go through related to data standards and interoperability?

Using common interoperable data standards and accounting for system interoperability is essential for ensuring that data can be seamlessly exchanged and used across different systems and organizations.

Workforce

How to keep the workforce engaged into their task in the digital journey?

Key question to answer is how to maintain the digital trust with the workforce. To share with the staff where their part fits into the bigger picture can be of help. To keep the workforce engaged, it can be an idea to organize close feedback loops on missing data or consistent data mistakes.

Why would you align the patient flow and digital flow in a hospital?

When going for a digital solution it is very important that the digital solution follows the patient throughout the steps within the hospital. For example, when a patient comes in at the reception of the hospital, the registration of the patient can be the first step into the digital system. As the next step, the patient might be with a nurse to do standard tests such as blood pressure, this information will go into the digital system. The third step into the flow, the patient sitting in front of the clinician, the relevant data might be entered into the system too. When the patient and the digital flow are aligned, it adds value, and it is convenient for the workforce.

What are key questions to answer for the hospitals in Africa?

- What is the added value for the hospital, for the clinical site?
- How to assess the digital maturity of your site?
- Who are the sites that have implemented an eMR to learn from? Who are the front-runners?
- Who will be clinical site's IT local partner or business partners to work with?
- What is the decision process of using an on-premises hosting or cloud solution?

Overview of potential advantages of electronic records from different perspectives

Patient level

- **Reduced waiting times**: having an electronic administrative process will reduce patients' time waiting for registration, appointments, and procedures.
- **Economic benefit**: Patients, especially in public hospitals, pay for their files for every visit they make to the hospital, and most health insurance funds do not cover this cost.
- **Patient Safety**: eMR systems may provide clinical decision support tools, for example, prescriptions and dosages, to help healthcare providers make safer and more informed decisions, reducing the risk of medical errors, especially in children.
- **Better Continuity of Care**: Electronic records are accessible across different departments and locations, ensuring that healthcare providers have a complete view of a patient's medical history, for example, prior history of surgery. The patient may not remember the intricate details, and a different clinician may see them. Retrieving these details is easier when using an eMR.
- **Increased patient engagement and empowerment:** Patients will have better access to their health records. Patients can access their records, test results, and appointment schedules online, promoting self-management and communication with healthcare providers.

Healthcare workers (doctors, nurses, nutritionists, physiotherapists, patient aides…)

- **Increased efficiency:** eMR systems reduce the burden of keying in patient notes and putting in doctor's orders and nursing notes. This will save them time and allow them to focus more on patient care. With different variations in handwriting, eMR systems resolve this ambiguity

and uncertainty. The electronic medical system also optimizes hospital workflow, especially in the Outpatient Department, leading to more efficient and timely patient care. Having clerkship templates for example theater notes, pediatrics notes will save the time spent documenting patient's records.

- **Telehealth support:** Electronic records support the integration of telehealth services, allowing for remote patient monitoring and consultations.
- **Reduced redundancy**: Eliminating the need for redundant tests and paperwork can save time and resources.
- **Improved Communication & Collaboration between teams:** Electronic records facilitate seamless communication between healthcare providers, making it easier to share patient information and coordinate care between different teams; for example, if a patient in the pediatric ward needs a surgical consult, it is easier for the surgical team to access the patient's notes with eMR and collaborate with the medical team.
- **Decision Support**: Clinical decision support tools assist healthcare workers in making evidence-based decisions and adhering to best practices, for example, avoiding prescription errors, especially in children. Machine learning- diagnoses save time.

Policy level

- **Epidemiology and surveillance support:** Access to large datasets for analysis and research enables policymakers to identify healthcare trends and implement measures for quality improvement. It will be easier to identify outbreaks and act accordingly.
- **Cost-effectiveness**: Transitioning to eMR systems can save long-term costs by reducing the need for physical storage space, paper, and administrative staff. The storage of the patient's records will be safer away from weather elements- oxidation, fires, floods.
- **Environment conservationists**: By using less paper, we save our trees!

6. eMR implementation, considering People, Process and Technology

We applied the "Design Thinking" problem solving approach to create a design thinking path for the eMR implementation focusing on People, Process and Technology via questions and answers. This is an iterative and collaborative process which often leads to more effective and innovative solutions.

1) **Empathize - Research your users' needs. What is your current situation and what would be most important for you, what is your steppingstone and why would you start implementing an eMR solution? Where are you in the digital journey?**

   a. People – How to convince sites to go for an eMR solution, where their primary focus is clinical care of patients? A digital solution for key data could drive efficiencies for the people the site staff, linked to the patient flow, day-to-day work and the local needs.

   b. **People** – **Stakeholder Engagement** - Identify key stakeholders, including government health departments, healthcare providers, technology companies, and international

organizations. Establish a collaborative task force for eMR implementation on site level.

    c. **Technology and Process** – To understand, where the site is in the digital journey there is a tool to assess the readiness

        1. The eSOURCE-READINESS ASSESSMENT TOOL (eSRA) - The tool contains questions based on regulations and regulatory agency guidelines for clinical research data sources and should be used to evaluate the suitability of an Investigator Site computerized system to provide data for clinical trials. (eClinicalforum, 2024) https://eclinicalforum.org/esra

        2. Site EHR readiness survey questions (EHRsite readiness)

    d. On longer term, the digital solution, might help to answer a data or research question. What are the data questions to answer today and in the future? Make sure that the solution and data format the site is going for is compatible with requests at national level.

2) **Define - State your users' needs and problems. How does the digital transformation fit into your site strategy and your business model?**

    a. **People** – here you want to start thinking about the change management process and the communication plan accordingly. What is the impact on the work force? How to convince the health workers? Who can be the early adapter and your change agents?

    b. **Process** to come to a Strategic and Business plan. To include value proposition for the site, site staff, patients, and authorities. It is key to develop sustainable funding models for ongoing eMR maintenance and upgrades. Explore public-private partnerships and international aid opportunities.

    c. **Process:** Understanding how the site perspective fits in a bigger picture (network of sites, national level…). Why is standardization important? Doing it right the first time to ensure the data adds value beyond the site perspective: data generation drives insights at site level, national and potentially regional and global level (data sciences, market access, disease surveillance).

3) **Ideate – Challenge assumptions and create ideas.**
What possible technology solutions can be implemented as an eMR solution?

    a. **People**

        i. To have a resource or resources to focus on the implementation of a digital solution is key, dedication is key. Establishing a collaborative task force could be a way forward.

        ii. How to build digital trust? What could help?

            • Give ownership to the site staff,

            • Go for African led solutions,

            • Go for small realizations where the benefit and value are visible for the staff who contributed to make this happen

    b. **Process**

        i. What is new and needed in the transition from paper to eMR? change to documentation process, security, disaster recovery

        ii. Regulatory framework:

- Develop or adapt healthcare data privacy and security regulations to protect patient information.
- Establish legal frameworks for interoperability and data sharing. What are ways to start?

c. **Technology and infrastructure investment, what should be considered:**
   i. Invest in building or upgrading reliable and secure internet connectivity in healthcare facilities, especially in rural areas.
   ii. Ensure stable power sources, considering renewable energy options.
   iii. Hardware Procurement: Source and distribute necessary hardware, such as computers, tablets, and smartphones, to healthcare facilities. Ensure compatibility and durability of hardware in challenging environments.
   iv. What is the advantage of a on-premises hosting or cloud solution?
   On-premises hosting refers to the practice of hosting and maintaining an organization's IT infrastructure and applications within its own physical facilities, rather than relying on external cloud services or data centers.
   The decision depends on your expertise and the specific needs of your site.

   The advantage of on-premises hosting is that you have full control over the server and the data and no recurring hosting cost. The downside is that you must buy and maintain the server and replace it when it's broken. Also, you need to consider how about back-ups and disaster recovery processes if the server is local. In the SaaS environment, you have no upfront hardware cost and maintenance, and updates are handled by the provider. It is also more scalable (easier to add resources). The downside is the recurring cost for hosting, and you do not own the server.

d. **Technology**
   The advice might be to go for open-source and scalable solutions. You can volunteer to be part of an Open-Source Community of Practice.
   If you go for eMR solutions, the below are examples of possible solutions used in SSA: (DigitalSquare, 2023)

   OpenMRS: OpenMRS is an open-source eMR system designed for resource-constrained settings. It's highly customizable and has a strong community of developers. It has been widely used in SSA and adapted to various healthcare environments.
   Bahmni: Bahmni is an open-source healthcare system that includes eMR functionality. It is designed for low-resource settings and can be integrated with other systems.
   OpenEMR: OpenEMR is another open-source eMR system suitable for clinics and small hospitals. It is user-friendly and can be customized to local needs.
   MediCapt: MediCapt is a mobile EMR solution designed for use in low-resource settings. It is designed to work offline, making it suitable for areas with limited connectivity.
   District Health Information Software (DHIS2): DHIS2 is more of a health information system but can be customized to include EMR capabilities. It's widely used in SSA for data collection, management, and reporting.

Africacode: Africacode is an open-source eMR solution designed to meet the needs of healthcare facilities in Africa. It aims to address the unique challenges faced in the region.

Medsphere Systems: Medsphere offers an open-source solution called OpenVista that can be tailored to healthcare needs in SSA.

Medsenior: Medsenior is an eMR solution designed for small and medium-sized healthcare providers. It is user-friendly and can be adapted to SSA settings.

ClinicMaster: ClinicMaster is a healthcare management system designed for the African market. It offers EMR functionality along with other healthcare management features.

Besides technology an important question to consider is who will support you from an IT support perspective:
 - Do you have an existing internal IT partner or will you work with an external partner?
- What are the options if you go for a local IT partner?

4) **Prototype - Start to create solutions.**
   a. **People -** Healthcare Workforce Training:
      - Provide comprehensive training to healthcare professionals, administrators, and support staff on the use of the eMR solution. Make sure the Change Agents are part of this training.
      - Offer ongoing training and support to keep skills up to date.
      - Technical Support: Establish a dedicated technical support team or helpline to assist healthcare facilities with software and hardware issues.
   b. **Process**
      - Implement robust data security measures, including encryption, access controls, and regular security audits.
      - Educate healthcare providers about patient data confidentiality, if needed.
      - Quality Assurance:
         - Develop quality control processes to ensure accurate and reliable data entry.
         - Monitor and audit eMR usage to maintain data integrity.
   c. **Technology - here we are offering an eMR implementation planning template for you to work with.** See transition map paper to eMR.

5) **Test: Try your solutions out and continue to build skills on data literacy and invest in process and training.**
   a. **People -** What is new for the staff, now that the eMR is live? What is expected from them? Who are the early adapters that can help with the change management process?
   b. **Process on the longer term**, an eMR solution might help in optimizing patient recruitment, allowing remote monitoring and plugging in new data sources and enable the use of common patient information across sites. Evolution content of eMR linked to business continuity.

c. **Process - Performance Evaluation** - Continuously monitor the impact of eMRs on healthcare outcomes, efficiency, and accessibility. Gather feedback from healthcare providers and patients.
d. **Technology** – Adapt to evolving healthcare needs and technological advancements. Are there existing systems that would benefit from integration? Expand eMR implementation to cover additional healthcare services, such as telemedicine and public health monitoring.

7. Transition map paper to eMR

The implementation of an eMR solution at site will be a **phased approach with learnings**. When defining the eMR transition, it is important to evaluate the whole value chain of the site, including patient care, business economics, quality and compliance, IT-capacity and technical aspects. Therefore, within the playbook, various key capabilities are highlighted, including the development of the core technical requirements.

Implementing electronic medical records in the African continent requires a comprehensive and adaptable transformation map due to the unique challenges and opportunities presented by the continent. This map should consider factors such as infrastructure limitations, diverse healthcare systems, and varying levels of technological readiness.

There are studies, such as the one from JK. Kabukye, et al, in PLOS (Kabukye JK, 2020) which identified variables that are relevant for measurement of **organizational readiness to implement an eHR** in an oncology center in a low-income setting. According to this study they are: vision clarity, change appropriateness, change efficacy, presence of an effective champion, organizational flexibility, and collective self-efficacy. In addition, they assessed organizational readiness and identified action points and considerations for enhancing readiness at a specific institution, UCI. They found that the UCI, while ready to implement an EHR, should pay attention to staff's computer skills, training of staff on EHR, available computer infrastructure, and should devise a strategic implementation plan. Whereas staff have a good understanding of the benefits of eHR implementation, which is important for high readiness, sensitization is also needed since some staff want to implement the EHR "just because everyone else is doing it."

The below is an example of an **eMR implementation planning steps with the focus on technical prerequisites**:

1. Requirements Gathering
Complete requirements document
Review and finalize the requirements with stakeholders.
Define metadata (standard coding for diagnosis, lab, …)
Design different forms (HIV visit, medication refill, lab request, …)
Define reporting requirements on patient level and program level
Define user roles (application users, application admin, analyst, admin, ..)

2. System Design
Create a high-level system architecture
Select the OpenMRS modules to be used
Implement interfaces with other systems (DHIS2?)

3. Development
Set up the development environment
Configure requirements in OpenMRS
Integrate with other systems
Develop reporting and visuals

4. Testing
Set-up QA-environment
Create testscripts
Perform testscripts
Bug fixing

5. Deployment
Set-up production environment
Load meta-data (clinics, programs, medications, …)
Set-up user accounts with roles
Conduct a pilot
Monitor and bugfixing

6. Training and Documentation
Develop user manuals, system documentation, and training materials
Conduct training sessions for end-users and relevant stakeholders
Dry-run after training

7. Maintenance and Support
Set-up contract for maintenance and support
Monitor system performance
Plan for regular system updates and patches
Install change management process

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