Digital Health Records

Digital technology, applications, data, and information systems, as part of the ongoing transformation of health and health care can help ensure universal and equitable access to affordable, people-centered, and integrated quality care, contributing to the goal of reaching Universal Health Coverage (UHC). Intelligent use of data and digital technologies can elevate patient experience, improve staff satisfaction, drive operational efficiency, improve patient outcomes, and create new business models, with benefits for both the public and private sectors.

This Implementation Know-How Brief provides World Bank Group staff, country teams, and other organizations involved in the implementation of Digital-in-Health activities with practical discussions, key terms and considerations, and broad guidance on how to engage with clients on the topic of digital health records.

This Brief Will Help Stakeholders to:

- Learn about key terms and relationships between them to understand the difference between types of digital health records (e.g., electronic health record and electronic medical record)
- Learn about the potential benefits of implementing digital health record systems
- Advise health authorities on assessing the need for digital health record systems, and establishing a clear purpose for any new digital health record systems
- Assess digital health maturity and existing medical record system(s), and understand the implications of these assessments on the development of new digital record systems
- Achieve a comprehensive understanding of the key steps involved in developing and implementing digital health record systems

Why are Digital Health Records Important?

With the plethora of health data available these days – from individual wearables like a smart watch to an app by a community health worker or even genomics data – data about a person’s health status can be kept by organizations or institutions other than health care providers. Data that affects a person’s health and wellbeing might not even be kept by organizations that consider themselves to be supporting a person’s health. For example, education providers of Government departments that keep data about a person’s education status or the grants that
they receive, also have data that have a bearing on a person’s health. Figure 1 illustrates this relationship between data kept in digital health records and all the other data about health.

**Figure 1  Data about health and healthcare**

![Diagram illustrating data about health and healthcare](image)

These data, all combined, form a digitized picture of a person’s health.

This brief focuses on digital health records. Digital health records are so much more than digital versions of paper-based patient charts. When they serve specific purposes, are widely available, and their contents are both timely and accurate, digital health records have enormous potential to transform health care planning, financing, delivery, and promotion. Having a specific purpose is crucial for digital health records to deliver benefits.

To deliver benefits to patients, health care providers and health systems, EMR and EHR systems must serve specific purposes that are clearly tied to broader health care system policies and objectives. EMR and EHR systems without a clear purpose are unlikely to deliver benefits and to be financially sustainable.

As illustrated in table 1 below, there is a long (non-exhaustive) list of potential benefits associated with digital health records. However, it is important to note that the benefits a specific digital health record system can attain depends on its purpose.
### Table 1  Non-exhaustive list of potential benefits associated with EMR and EHR systems

| Access to patient records | • Providing accurate, up-to-date, and complete information about patients at the point of care  
|                          | • Securely sharing electronic information  
| Maintaining records      | • Helping promote legible, complete documentation and accurate, streamlined coding and billing  
|                          | • Better ways to ensure privacy and security of data  
| Patient engagement and satisfaction | • Quicker and easier communication with patients  
|                          | • More benefits for patients with chronic conditions  
|                          | • Patients do not need to repeat same information  
| Care quality and outcomes | • Decision support tools aligned with clinical guidelines  
|                          | • Better disease management and patient engagement  
|                          | • Lower health risks to patient from duplicate examinations/procedures  
| Care coordination        | • Access 24/7/365 to patient data in any place at any time  
|                          | • Enhanced communication across health care providers  
|                          | • Links to shared registries and databases  
| Health system performance | • Time and resource savings from automated procedures  

Lower overall spending due to improved safety
Better targeting and use of cost-effective therapies

Monitoring and surveillance
- Alerts on active disease outbreaks.
- Enhanced public health and biomedical research.

Source: Based on (World Health Organization 2006; Walker, Bieber, and Richards 2005; Nelson, Cafagna, and Tejerina 2020; Health Information and Quality Authority 2018) as well as webpages from the United States Office of the National Coordinator for Health Information Technology (ONC)

What are Digital Health Records?

There are many terms that are used to refer to health or medical records in digital form, or digital health records (a health record is a history of an individual’s health). Terms include electronic health record, electronic medical record, computerized patient record, personal health record, electronic patient summary, and shared health record. There are no widely accepted and used definitions for these terms. This brief differentiates between four types of digital health records: electronic medical records (EMRs), electronic health records (EHRs), patient summary records, and personal health records. The brief focuses mostly on EMRs and EHRs. Digital health records are one source of health data (or data concerning health); there are many other sources and types of data that concern health (such as disease surveillance and clinical trials), as discussed in a separate Implementation Know-How Brief on data governance in health.

To avoid misunderstandings, Task Team Leaders should be mindful that countries and organizations will have their own preferred terms and definitions for digital health records. The definitions adopted in this brief for each term, and the relationships between terms, may be helpful in framing discussions with clients.

Whenever a patient sees a health care provider (such as a general practitioner, specialist in a clinic or in a hospital, long-term care worker, or a physiotherapist), the provider typically creates a record of that appointment, either in paper or digital form. The digital form of such a record is the EMR, sometimes called an electronic patient record. It is a digitized medical record (or computerized patient record) created by a health care provider, often unique to that provider, containing both demographic and longitudinal medical information on a specific patient, for the purposes of diagnosis, treatment, management, follow-up, and referral.

Medical laboratories, pharmacies, and even mobile application providers and technology companies (such as Apple Health), also create digitized patient records that, under the definition of EMR used in this note, are also considered to be EMRs. There are other sources
and types of data concerning health that could be included in an EMR (such as education level, exposure to pollution), but these other data are not considered EMRs. It is important to keep in mind that EMRs serve specific purposes as defined above, for example, a supermarket chain may keep a record of an individual’s purchases (through a loyalty card) and this data may be relevant to their health, but such a record does not constitute an EMR under the definition used here. When a patient visits different health care providers (for example, goes to a dermatologist after being referred by a general practitioner or has a diagnostic test done by a laboratory), or when they use different health apps, there will often be as many EMRs as there are providers/apps. Even within large providers—such as academic hospitals—different departments may have different EMRs, each one containing different parts of an individual’s health care journey and health system interactions.

If different health care providers decide to share some of the data contained in their EMRs with each other, then an EHR, is created: a longitudinal digital record that contains a history of all patient contact with multiple health care providers regardless of the settings, service and organization at which the contact took place (OECD 2019). As EMRs, EHRs can also be expanded to include data from other sources. Data that were not collected by health care providers, but that may be included in EMRs and EHRs can come from a wide array of sources including public and private organizations (such as schools and universities, workplaces, technology companies, research institutes, biobanks, and grocery stores) as well as patients themselves (such as self-monitoring, wearable devices like smart watches, and mobile apps).

As discussed later in this brief, EHRs are usually complex and costly to set up, and need to have a specific purpose to be financially viable. For this reason, EHRs are typically adopted by large health care organizations (like health maintenance organizations), health subsystems that group multiple providers, and by subnational and national authorities. In fact, EHRs are not limited by national borders. The European Commission has been working to allow European patients’ EHRs to contain information not only from providers in their country, but also from providers in other European countries where they may have sought care (European Commission 2019).

In theory, the most comprehensive EHR is a complete digital record of a patient’s health journey, throughout their life, across all health and social care settings, containing all types of health information and data: the patient’s symptom history, past history of illnesses and operations, clinical observations such as a blood pressure reading, blood and other test results, X-rays and scan results, prescriptions and other treatments, care advice, the course of an illness, preventive and public health activities such as immunizations, and activities undertaken by patients to stay healthy (Health Information and Quality Authority 2021). In practice, it would be challenging to achieve such a comprehensive record; it would require investing huge effort into integrating all data from all EMRs, and – without a clear purpose – this would not be justified. That is why some countries have focused on implementing a type of EHR that is called patient summary record². Patient summary records contain only essential health information (such as demographics, health conditions, current medications, recent procedures, diagnosed allergies, and vaccinations), often sourced from multiple EMRs or other EHRs, that can be
made available at the point of both planned and unplanned care, although they are usually adopted for the purpose of emergency care.

Most EMRs, EHRs and patient summary records are created and controlled by health care providers and health authorities. **Personal health records**, on the other hand, can be created by both health care providers and patients but, crucially, are controlled by patients3. Examples of personal health records include Google Health and Microsoft HealthVault. Personal health records can be linked to EMRs and EHRs (provide patient’s view of these EMRs and EHRs), but this is not necessarily the case in practice.

**What are EMR and EHR Systems?**

To create, populate, maintain, share, and use an EMR or EHR, it is necessary to first set up a system—an EMR system or EHR system. These EMR and EHR systems not only allow all the data that make up these records to be collected and stored in a systematic way, but they also include all the platforms, applications and services that sit on top of the EMRs and EHRs and add functionality that support business processes. It is important to understand that, from the data-oriented point of view, EMRs and EHRs are just records, systematic collections of patient data; EMRs and EHRs by themselves have no functionality. It is EMR and EHR **systems** that provide functionalities that support business processes around EMRs and EHRs thus allowing policy makers, health care professionals, and patients to use the information contained in EMRs and EHRs to promote health and achieve health system objectives.

The International Organization for Standardization (ISO) defines an EHR system as a system comprising one or more data repositories, directory services listing human and other resource entities, knowledge services containing terminological systems, care pathways and workflows, end user applications, reporting modules, and security services, among other components4.

Typical functionalities of EMR and EHR systems are shown below (Institute of Medicine of the National Academies 2003; Nelson, Cafagna, and Tejerina 2020; Walker, Bieber, and Richards 2005).

**Table 2  Examples of functionalities of EMR and EHR systems**

<table>
<thead>
<tr>
<th>Functionality</th>
<th>EMR Systems</th>
<th>EHR Systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage and retrieval of health information and data</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Results management</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Order entry/management</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Referrals and authorizations</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Decision support management</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Determination of patient eligibility</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Health risks appraisals and wellness education | Yes | Yes
Electronic communication, including secure e-mail | Yes | Yes
Patient support, access, and editing | Yes | Yes
Administrative processes, scheduling, and demand management | Yes | Yes
Claims submissions and management | Yes | Yes
Reporting and population health statistics | Yes | Yes

The more information that is contained in an EMR or EHR, and the more functionalities that are built on top of it, the larger and more complex the EMR or EHR system will need to be, and the more dependent the system will be on other digital health systems. When these other systems are not in place, some of the functionalities listed above may not be available. It is important to note that within a country there can co-exist many EMRs, EHRs, and EMR and EHR systems.

An increasingly important functionality of EMR and EHR systems is to give patients access to their EMRs, EHRs and patient summary records, typically through citizen health portals or patient health portals. Some countries, like India, even aim to make patients responsible for consenting to their health data being seen by different providers in the system. These portals allow patients to see some, or all, of the information contained in their records, take certain actions (such as make appointments) and potentially even edit the information contained in their records (change, add or even delete information). Patients may also be able to share their preferences regarding which health care providers get access to their records, and whether their data can be used for secondary purposes (such as public health research). While some governments do give patients significant control over their records (for example, in Australia, patients may even permanently delete their record), most EMRs, EHRs and patient summary records are created and controlled by health care providers and health authorities.

Figure 2 illustrates how the different terms for digital health records relate to one another, as well as to at least two other important sources of data that are typically included in an EMR or EHR: the master patient index (MPI) and master registries, and other registries. An MPI is an identification mediation service, maintained separately from a patient’s medical record, that ensures accurate and timely patient identification within a certain context (such as health care organization, region, country). Master Registries are coding systems/services that ensure accurate and timely identification of basic entities referenced by all other systems. Registries are organized systems that collect uniform data (clinical and other) to evaluate specified outcomes for a population defined by a particular disease, condition, or exposure (for example, cancer, diabetes).

Figure 2  Illustration of how digital health records relate to one another and to other systems
How all these sources of data are organized and how they relate to each other is important. Often, data are kept separate in standalone information systems with duplicate information—like the names and locations of health facilities, or the names of health workers, or the standard list of medications available in the country, or the standard list of diagnosis codes—all repeated in these separate, standalone information systems. If these systems are not somehow connected, then this leads to inaccurate information that is unrelatable and difficult to change: if a health facility name or location changes, that change might need to be made in multiple places. This causes information systems to contain partially correct data and is cumbersome. This is illustrated in Figure 3.
**Figure 3** Examples of common types of data contained in different health information systems

<table>
<thead>
<tr>
<th>Information System 1</th>
<th>Information System 2</th>
<th>Information System 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Primary Healthcare EMR</strong></td>
<td><strong>Laboratory Information System</strong></td>
<td><strong>Logistics Management Information System</strong></td>
</tr>
<tr>
<td>Patient visit data</td>
<td>Laboratory test results</td>
<td>Primary healthcare sites and locations</td>
</tr>
<tr>
<td>Patient name and details</td>
<td>Patient name and details</td>
<td>Medicine list</td>
</tr>
<tr>
<td>Primary healthcare sites and locations</td>
<td>Laboratory test types</td>
<td>Medicines at PHC site</td>
</tr>
<tr>
<td>Healthcare workers and PHC site</td>
<td>Healthcare workers who ordered the test</td>
<td>Medicines at hospitals</td>
</tr>
<tr>
<td>Diagnosis codes and descriptions</td>
<td>Diagnosis codes and descriptions</td>
<td>Transport routes</td>
</tr>
<tr>
<td>Medicines list</td>
<td>Supplies needed for laboratory tests</td>
<td>Transport drivers</td>
</tr>
<tr>
<td>Medicines at PHC site</td>
<td>Health workers at laboratories</td>
<td>Health workers at warehouse and health facilities</td>
</tr>
</tbody>
</table>

The use of master registries and a health information/data exchange layer (often called an interoperability layer), as illustrated in figure 4 below, allows health data that are distributed across multiple information systems to be managed more efficiently, with fewer errors, leading to more complete sources of data that are also better protected. One initiative that tries to foster the use of a health information/data exchange layer, is the Open Health Information Exchange, or OpenHIE, Initiative. OpenHIE is both an opensource community and initiative that seeks to improve the sharing of health information across different systems and countries. The primary goal of OpenHIE is to enable scalable and sustainable health information exchange (HIE), particularly in low- and middle-income countries. OpenHIE is not a software product itself, but rather a framework and architecture for interoperability. It provides a set of principles, standards, and guidelines for implementing HIEs that can be customized to meet the specific needs of different countries and health care systems.
Implementing EMR and HER Systems

Architectural approaches to EMR and EHR systems

The typical strategic dilemma in implementing EMR and EHR systems is how and where to implement them. Is one EMR system to be used by all primary health care facilities? Should primary health care facilities be able to implement different EMR systems, but in a regulated environment? There are many architectural solutions for implementing EMR and EHR systems at different levels (for example, national, regional, city, network, health care provider), from centralized databases, to distributed and cloud systems, to platforms and HIEs that allow multiple different EMR and EHR systems to work together, to hybrid models that combine centralized and distributed solutions. Generally, there are four types of basic architectural approaches, as illustrated in figure 5.

The choice of architectural approach—or combination of approaches—will depend on the scope of the EMR or EHR system(s) being implemented, the number and levels of stakeholders.
involved, their digital health maturity or organizational readiness (including the existence of legacy systems: older digital health systems, including hardware and software, that are already in place), and the resources available (both financial and human). It is also important to note that it is not necessary to apply the same approach to all contexts; for example, a government may decide to implement one EMR system for all primary health care facilities but to use different EMR systems with different functionalities for hospitals.

Whatever the architectural approach is, the EMR and EHR systems need to fit into the overall digital health enterprise architecture, to become part of the same digital health ecosystem. The WHO defines enterprise architecture frameworks or methodologies as “blueprints of information systems, commonly used to help implementers design increasingly complex systems to support the workflow and roles of people in a large enterprise such as a health system” (World Health Organization and International Telecommunication Union 2020). A part of the enterprise architecture is the information architecture, which includes both the data architecture and the applications architecture, which includes EMRs, EHRs as well as EMR and EHR systems.

Implementing EMR and EHR systems can necessitate investments in both hardware and software, including in many other health information systems (HISs), registries, platforms, and applications and services that may or may not already exist in a country, region, city, network of providers, or single health care provider. The investments that are made, and the systems that are available will determine what functionalities a specific EMR or EHR system has, and what purpose(s) it can serve.
The process of implementing an EMR or EHR system will differ depending on whether the system is being implemented in a small practice, a large health care provider, a group of providers, a subnational area, an entire country, or potentially even a group of countries (for example, the European Union).

The purpose of an EMR or EHR system will determine the complexity of the implementation. The larger the geographical and functional scope of the EMR or EHR system, typically the more complex the implementation will be. Similarly, the larger and more decentralized the jurisdiction in which the system is being implemented, the more complex the implementation will be. Table 3 below illustrates, using a hypothetical example, how many EMR and EHR systems implemented in different jurisdictions can co-exist. These different systems may or may not be able to exchange information between them. A country where many EMR and EHR systems already exist will be focused on how to better integrate and optimize their assets, whereas a country where no EMR or EHR systems are in place (all medical records are still paper-based) will be focused on laying down the foundations on which digital health record systems can be built.

**Table 3 Hypothetical illustration of how EMR and EHR systems can be used across jurisdictions**

<table>
<thead>
<tr>
<th>Example or purposes</th>
<th>Cross-country</th>
<th>Country</th>
<th>Subnational area</th>
<th>Network providers</th>
<th>Single providers</th>
<th>Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reporting</td>
<td>EHR System A</td>
<td>EHR System B</td>
<td>EHR System D</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Order entry &amp; management</td>
<td></td>
<td></td>
<td></td>
<td>EHR System F</td>
<td>EHR System G</td>
<td></td>
</tr>
<tr>
<td>Patient engagement</td>
<td>EHR System C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Health data repository</td>
<td></td>
<td></td>
<td></td>
<td>EHR System H</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All of the above</td>
<td></td>
<td></td>
<td></td>
<td>EHR System E</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Different stakeholders are likely to be facing different challenges and have different objectives. For example, for national and subnational authorities, one key decision may be to make sure that all EMR and EHR vendors meet certain standards (potentially via a government approved certification process), while for health care providers the focus will be on the specific characteristics of each vendor’s EMR and EHR systems (such as costs and usability). As EMR and EHR systems can be large and complex, they are more likely to be implemented by larger health care organizations, networks or subsystems that group multiple providers (such as hospitals), or by large cities, subnational, and national authorities. Compared to smaller
practices (such as primary care practices and private solo practices), larger stakeholders are more likely to have both the substantial resources to implement EMR and EHR systems, and to be able to capitalize on their benefits. Many of the potential advantages of EMR and EHR systems listed above cannot be captured by smaller practices (such as, small clinics that implement EMR systems may increase generic prescribing, but the benefits will accrue to much larger health systems and subsystems).

Figure 7   Examples of roles and constraints of different actors within health system

<table>
<thead>
<tr>
<th>Central governments</th>
<th>Provider networks and larger health care providers</th>
<th>Smaller health care providers</th>
</tr>
</thead>
<tbody>
<tr>
<td>set the overall direction and put in place incentives or even requirements that subnational governments and health care providers must meet in their strategies and implementations of EMR and EHR systems.</td>
<td>In federated countries, subnational governments may play a key role (sometimes more than central governments) in determining how EMRs and EHRs are structured, standardised, funded, implemented, and ultimately used.</td>
<td>(such as private solo practices) will have fewer resources but will also need less complex EMR and EHR systems. They may lack incentives to adopt systems as they may not be able to capture many of the benefits.</td>
</tr>
</tbody>
</table>

There are many EMR and EHR implementation guides available, but almost all of them focus on health care providers implementing a specific EMR and EHR system in high-income countries, and not on national and subnational implementations that may involve many providers with multiple EMR and EHR systems in low- and middle-income countries (LMICs). Examples are provided in Annex. The only guide that focuses on both providers and governments in LMICs is WHO’s “Electronic Health Records: Manual for Developing Countries” from 2006. Task Teams contemplating which guides and steps to follow should first consider defining the EMR and EHR scope and functionalities that their clients are interested in.

Key Considerations for Policy Makers

Very generally, key elements and components to consider, at national and subnational levels, when implementing an EMR or EHR system can be grouped into four broad stages: an initial assessment and agreement on purpose, assessment of current situation, design stage, and finally implementation.
Assessment of Needs and Establishing Purpose

As with any large-scale digital health implementation, a necessary first step is to understand how EMR and EHR systems will contribute to broader health system goals, challenges, and strategies, including national and subnational digital health strategies. An initial and broad assessment can be used to identify the need/demand for EMR/EHR systems at the macro-level to determine the scope and functionalities of new EMR and EHR systems, in other words the purpose(s) that the system is supposed to serve. A typical oversight at this stage is an assumption that EMR and EHR systems are needed regardless of a clear purpose, and the more comprehensive they are the better. While there is evidence that utilization of EMR and EHR
systems brings value to the health care system (as shown in the list of potential benefits above), the functional and geographical scope of an EMR/EHR system is not necessarily aligned with health care system goals and strategies. Key considerations at the initial stage are:

- **Alignment with overall health system goals and strategies.** National and subnational governments have certain goals and strategies to achieve those goals that are aligned with the overall political, economic, and technological environments. To illustrate, a middle-income country may look for digitalization of health records to transform service delivery and improve the quality of care, while a low-income country, with a fragile political situation, may be looking for rudimentary data collection on basic health indicators. In the first instance, a systemic, comprehensive approach to implementing EMR systems (and then building EHR systems on that foundation) could be an appropriate process to follow, while such an approach would be inappropriate for the second use case.

- **Alignment to on-going reforms.** Health system transformation is challenging. Reforms can be strategically aligned to the overall health system goals but are typically implemented in the form of programs or projects with specific objectives. These programs/projects can be vehicles to deliver EMR/EHR systems. The purpose that EMR and EHR systems will serve needs to be aligned with other on-going efforts for two major reasons: health reform programs/projects can benefit from EMR/EHR system utilization; and reform programs/projects are a priority for governments or subnational administrations, so any EMR/EHR system development that is “outside” of these priorities will most likely not get due focus and support. To illustrate, a country that is implementing primary health care financing reform through the introduction of result-based payments, will have a need and priority for implementing EMR systems for primary health care with certain functionalities, but probably not a need to implement EMR systems in hospitals, nor a centralized EHR system for public health data analytics.

The need and demand for EMR/EHR systems should be clear and agreed upon among key stakeholders. Implementing EMR and EHR systems without a clear purpose will most likely deliver little to no value and is likely to be unsuccessful. At this stage, the detailed design and cost/benefit analysis of EMR or EHR systems is not necessary, but the purpose and overall scope and coverage should be clear and included into subsequent planning and investment documents and decisions. In the context of World Bank supported projects, an EMR/EHR system implementation should be included in the theory of change. An example of a stylized EMR/EHR system implementation related theory of change is provided in Annex. The EMR/EHR system implementation should clearly contribute to the WBG funded project objectives.

To achieve these initial stage objectives, it is advisable to form a planning committee which includes representatives from all key stakeholders to:

- Identify health system strategic goals, immediate objectives, and stakeholders' business needs
- Facilitate the discussions on EMR/EHR systems purpose and objectives
- Propose policies and strategic plans for EMR/EHR systems implementation
- Serve as a communication vehicle between stakeholders
- Advocate for EMR/EHR system utilization and the benefits they confer
- Make sure the process is collaborative and that all stakeholders are fully involved

**Assessment: Baseline Conditions & Building Blocks**

Once the purpose and overall scope and coverage has been decided, the next two steps are to: assess digital maturity and assess existing medical record systems. These assessments will be required to establish realistic expectations for the EMR/EHR system design and implementation.

Starting from baseline assessments of digital maturity and existing record systems is key to establishing realistic goals and expectations for EMR and EHR systems, determining whether the basic building blocks are in place, and establishing sensible timelines and budgets.

There are many toolkits and guidelines for conducting a digital health maturity assessment, some of which have been developed by the World Bank Group. There is an Implementation Know-How Brief for Team Task Leaders on the topic of which toolkit/guideline to use. The 2019 HIS Interoperability Maturity Toolkit, by MEASURE Evaluation with Health Data Collaborative, could be a useful tool in the context of EMRs and EHRs. Whichever digital health assessment toolkit or guideline is used, the WHO/ITU building blocks for electronic/digital health (see figure above) are useful in framing the assessment. Task Teams should seek and review previous assessments to establish if a new assessment is needed. Conducting an initial assessment is a good practice that is well-aligned with the Principles for Digital Development, specifically understanding the existing ecosystem, designing for scale, building for sustainability, and reusing and improving.

**Table 4  WHO digital health building blocks**

<table>
<thead>
<tr>
<th>Building block: Legislation, policy and compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ Are changes to licensing and legislation necessary to support EMRs/EHRs (e.g., access to health data)?</td>
</tr>
<tr>
<td>□ Are there liability issues for health workers using EMR and EHR systems?</td>
</tr>
<tr>
<td>□ Is there a clear legal framework for the use of EMRs and EHRs?</td>
</tr>
<tr>
<td>□ How will quality assurance and control be measured and validated?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Building block: Leadership and governance</th>
</tr>
</thead>
<tbody>
<tr>
<td>□ What is the political/ fragility context in the country/region and how is this managed?</td>
</tr>
<tr>
<td>□ Have public officials expressed formal written commitment to establishing EMR and EHR systems?</td>
</tr>
<tr>
<td>□ Is there a comprehensive health data governance framework to guide the use of EMRs and EHRs?</td>
</tr>
</tbody>
</table>

*Table 4 continued...*
Table 4  WHO digital health building blocks (continued)

<table>
<thead>
<tr>
<th>WHO digital health Building blocks: Non-exhaustive list of considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Building block: Interoperability and standards</strong></td>
</tr>
<tr>
<td>- Are there registry services in place? Do all patients, health care professionals and facilities have a unique identifier?</td>
</tr>
<tr>
<td>- Are there mechanisms for enabling data transfer and exchange between health care providers?</td>
</tr>
<tr>
<td>- Are medical terminologies and coding systems in use?</td>
</tr>
<tr>
<td><strong>Building block: Workforce</strong></td>
</tr>
<tr>
<td>- Do workers have skills needed to use EMRs/EHRs?</td>
</tr>
<tr>
<td>- Are there protocols to educate health workers in the use of EMRs/EHRs?</td>
</tr>
<tr>
<td>- Is there adequate staffing? Are health care professionals under pressure from multiple demands on their time?</td>
</tr>
<tr>
<td><strong>Building block: Strategy and investment</strong></td>
</tr>
<tr>
<td>- Are there sufficient financial resources to invest in EMR and EHR systems?</td>
</tr>
<tr>
<td>- Given enabling environment and existing infrastructure, how could EMR and EHR systems affect health inequities?</td>
</tr>
<tr>
<td><strong>Building block: Infrastructure</strong></td>
</tr>
<tr>
<td>- Can existing hardware be leveraged for EMR and EHR system implementation?</td>
</tr>
<tr>
<td>- Is current access to electricity and Internet connectivity appropriate for EMR and EHR system implementation?</td>
</tr>
<tr>
<td>- Is penetration of mobile phones and Internet connections appropriate for patient access to EMRs/EHRs?</td>
</tr>
<tr>
<td><strong>Building block: Services and applications</strong></td>
</tr>
<tr>
<td>- Can existing software applications be leveraged for EMR and EHR system implementation?</td>
</tr>
</tbody>
</table>

*Source:* Adapted from WHO (2019).

*Note:* There is some overlap between categories (e.g., workforce issues are also often legislation and policy issues).

Besides a macro-level review of digital health maturity, it is also key to review the existing medical record systems to assess the quality of current records and medical record systems, identify problems and prepare a formal assessment to inform the design of new EMR and EHR systems (World Health Organization 2006).
Table 5  Review questions of existing medical record systems

<table>
<thead>
<tr>
<th>Essential medical record keeping practices</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are medical records currently kept on all patients regardless of health care setting?</td>
</tr>
<tr>
<td>Is the medical record system centralized using a unit numbering system for all health care settings?</td>
</tr>
<tr>
<td>How are patients identified? Do all people have a national identification number? Is this used to uniquely identify the patient? If a national identification number is not issued what information is used to identify each patient?</td>
</tr>
<tr>
<td>Do health care providers have a master patient index and is it computerized?</td>
</tr>
<tr>
<td>How are medical records filed; is there a system?</td>
</tr>
<tr>
<td>Do health care providers currently have a record retention policy? If so, is it being applied?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Quality, timeliness, and completeness of existing medical records</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are medical records well documented? What is the quality of existing medical records?</td>
</tr>
<tr>
<td>Has all essential information been recorded, are all entries signed and dated?</td>
</tr>
<tr>
<td>Are quality checks performed on current records? If so, have any documentation problems been identified?</td>
</tr>
<tr>
<td>How do health care staff handle incomplete medical records?</td>
</tr>
<tr>
<td>Is there a problem with duplicate medical records?</td>
</tr>
<tr>
<td>If a patient’s medical record cannot be found, should staff prepare a new or duplicate medical record?</td>
</tr>
<tr>
<td>Is the information readily accessible and available?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reporting based on, and sharing of, existing medical records</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are reports produced based on medical records (e.g., daily admissions and discharge lists at hospitals)?</td>
</tr>
<tr>
<td>Are statistics collected and compiled based on existing medical records? Are there any problems with the collection and are statistics produced within the anticipated time frame?</td>
</tr>
<tr>
<td>How is information released for medico-legal purposes?</td>
</tr>
<tr>
<td>Are medical terminologies and codes used (e.g., ICD-11)?</td>
</tr>
<tr>
<td>Do health care providers have a policy for the release of information from medical records?</td>
</tr>
<tr>
<td>What is the policy on patient access to their health care information?</td>
</tr>
</tbody>
</table>

Source: Based on WHO (2006)

Solution design

The first step following a review is to establish a steering committee, with representatives from Government, future users such as health care professionals and patients, and technical experts in key disciplines, including health information, information and communication technologies, and health financing (for example, the Ministry of Health, health insurance agencies, Ministry of Interior, among others) (World Health Organization 2006). Involving end users early on is a key success factor (Fennelly et al. 2020). Engaging the public with respect to the collection,
use and sharing of health information is key to understanding the level of trust that exists, what is acceptable to individuals, and in building trust through the implementation of solutions that meet the expectations of populations (Health Information and Quality Authority 2021).

The **steering committee** will:

- Facilitate the discussions on EMR/EHR systems design
- Make sure the EMR/EHR systems design reflects the health system strategic goals, immediate objectives, and stakeholders' business needs
- Make sure that the EMR/EHR systems design respects findings of the assessments of digital maturity and status of existing medical records
- Propose policies and strategic plans for EMR/EHR systems implementation.
- Serve as a communication vehicle between stakeholders
- Advocate for EMR/EHR systems utilization, promote a utilization culture and the benefits they confer
- Pursue public communication campaigns to raise awareness related to the use of EMR/EHR systems and the benefits they confer at the patient level
- Make sure all stakeholders are fully involved
- Provide general guidelines to EMR/EHR systems consultants and/or other personnel who are involved
- Provide all necessary documents and other inputs to EMR/EHR systems consultants and/or other relevant personnel
- Arrange access to EMR/EHR systems for institutions, consultants and/or other relevant personnel
- Support EMR/EHR systems consultants in arranging workshops and other events
- Provide inputs for relevant EMR/EHR systems use cases
- Review the deliverables produced by EMR/EHR systems consultants and/or other involved personnel
- Evaluate the achievement of goals and make proposals for correctional decisions.
- Provide inputs for strategic decisions on investments in EMR/EHR systems and tools

One of the first points for discussion within the committee will be how the current level of digital health maturity and the existing medical record system(s) affect the **scope and functionalities of new EMR and EHR systems**. For example, a country where there are no national registry services and where electricity and Internet connectivity are not widely available, will need to focus on simpler tools that are less demanding in terms of infrastructure, while pursuing investments and efforts on these basic building blocks before moving forward with implementing more complex EMR and EHR systems. Indeed, low-income countries face significant challenges in implementing EMR and EHR systems due to, among other challenges, poor infrastructure (lack of stable electricity, unreliable Internet connectivity, inadequate computer equipment), limited technical support, low to no digital skills and training, and

Systematically addressing challenges arising from assessments of digital health maturity and the existing medical record system(s) is crucial to designing and successfully implementing EMR and EHR systems, and to avoid devoting substantial resources to systems that fail to deliver expected benefits.

Assessments of the current level of digital health maturity and the status of existing medical record system(s) are instrumental to determining the basic model for the EMR/EHR system development strategy. EMR and EHR systems can be developed as monolithic information systems, with clearly delineated scope and functions, typically implemented as vendors’ proprietary solutions, but also as digital health platforms consisting of re-usable, complementary cooperating services that deliver required functions.

The key advantage of implementing a vendor’s proprietary solution is that the design of such a system is likely based on years of experience, and usually instantly delivers a very rich set of functions “out of the box” that only needs to be adapted to the context. However, such systems sometimes operate in a silo and are not designed based on an underlying architecture that ties different systems together into a streamlined and cohesive whole. That may result in a lack of interoperability amongst information systems, consequently causing poor data management, absence of system-wide information and communication technology impacts, waste of digital health resources, and distractions from building national systems and infrastructure.

To tackle these challenges, the EMR/EHR systems implementation strategy can be based on developing a digital health platform (DHP) that enables the phased and coordinated introduction of EMR and EHR functions through shared resources and services. That can allow for the gradual development and implementation of digital systems and services to cover desired EMR/EHR functionalities which can be of crucial importance to countries with limited infrastructural and human resources capacity. The approach builds on the general DHP definition as “a common digital health information infrastructure (infostructure) on which digital health applications are built to support consistent and efficient healthcare delivery. The infostructure comprises an integrated set of common and reusable components that support a diverse set of digital health applications. The components consist of software and shared information resources to support integration, data definitions, and messaging standards for interoperability” (World Health Organization and International Telecommunication Union 2020).

A DHP can serve as an EMR/EHR systems developing environment that allows for an ambitious and comprehensive design that can be implemented gradually:

- The EMR/EHR system components are developed gradually starting from basic and relatively simple core common services that neither require expensive or complex technical systems, nor demand high technical capacity to run said systems.
The DHP can allow different exchange network architectures thus adapting to the infrastructural environment.

Even minor progress in DHP implementation enables immediate adaptation and connection of existing systems, improving their interoperability without requiring the shutdown of existing systems.

The implementation dynamics of EMR/EHR systems functions can be fully asynchronous and based on different models (for example, public versus private, proprietary versus open source), with the only requirement being the use of common DHP services, standards, and regulations.

Depending on progress, the EMR and EHR systems can be upgraded to meet new, more ambitious needs and requirements.

Depending on what is already in place (paper and digital), a decision will have to be made as to whether and how to migrate old medical records to new EMR and EHR systems.

A crucial consideration for national and subnational Governments is health data governance. Task Teams should stress the importance of having a national health data governance framework in place—or at least many of its elements—before proceeding with the implementation of EMR and EHR systems at scale. Such a framework should encourage the availability and use of personal health data to serve health-related public interest purposes while promoting the protection of privacy, personal health data and data security (OECD 2022a). The Organisation for Economic Co-operation and Development (OECD) Council’s recommendation on health data governance frameworks may be helpful. The Health Data Governance Principles—a comprehensive, global set of principles to guide the governance of health data across public health systems and policies—may also provide high-level direction. They have been endorsed by the World Bank Group.

Important data governance considerations pertain to patients’ rights to their data and secondary use of EMR and EHR data. As previously mentioned, people’s trust in the collection, use and sharing of their health information is key to well-functioning systems of digital health records. Governments should have a patient consent model for health information in place before adopting EMR and EHR systems. Such a model clarifies in which cases (such as, planned care, unplanned care, health promotion) patient consent is needed and how it should be given (for example, explicitly or implicitly). To further build trust, governments could also consider giving patients access to their EMRs and EHRs and potentially allow them to edit them. Consent is also important for secondary uses of EMR and EHR data, such as to monitor costs and health outcomes, or to conduct post-market surveillance of medications and population health research. Having a national organization to oversee secondary uses of EMR and EHR data, as well as other health data, could be constructive.

Another important consideration for governments is whether to introduce laws and regulations to require that health care providers meet standards for national and/or subnational EHRs, namely in terms of medical terminology, coding, electronic messaging, and interoperability (OECD 2022b). Governments may also use certification processes to guarantee that vendors of EMR and EHR systems conform to national and/or subnational standards. A
further step is to introduce financial incentives (or penalties) for health care providers to install EMR and EHR systems from certified software vendors, and to have these payments be conditional on systems being up to date with changes in national standards.

Establishing a national organization, governed by a multidisciplinary body with wide stakeholder representation, with primary responsibility for national EMR and EHR infrastructure and systems development could be productive. Such an organization could be responsible for setting, incentivizing, and enforcing national standards for medical terminology and electronic messaging, as well as what data must be included in EMRs and EHRs, and even rules regarding timeliness of EMR and EHR data updates. It could advise policymakers on technological matters, such as whether to use centralized servers or the cloud, how to identify and authenticate users of EMRs and EHRs (such as smartcards and multi-factor authentication), whether and how to encrypt health data that is being exchanged, and whether to use a dedicated, secured network for exchanging clinical data. Such an organization could be responsible for conducting audits of EMR and EHR systems to verify that they meet national requirements and to examine the quality of the data contained in digital records.

Besides involving users of EMR and EHR systems—both patients and physicians—in the design of the system, it is important also to consider how EMRs and EHRs might simultaneously increase and reduce inequities in access to health care and health outcomes. On paper, a national system that is successfully implemented throughout the country has the potential to reduce national health inequities by helping health care providers target those with the greatest need for health care and promotion. In practice, to implement a full-fledged system and to realize its potential benefits, providers need to be well-resourced and have many other information and communication technologies and systems already in place. There are—in high-income and LMICs alike—significant health and socio-economic gradients across regions: some are healthy and wealthy, while others face deprivation.

In regions with greater economic deprivation, health care providers may not have the basic building blocks to prop up EMR and EHR systems, from stable electricity supply, to access to broadband connectivity, to modern hardware (such as computers) and software (such as operating systems). The populations that are served by these health care providers are typically exposed to more health risks and have, on average, worse health outcomes, compared to their wealthier counterparts. The tragedy of this situation is that the places where EMR and EHR systems would have the most positive impact are those places where they are most difficult to implement and are least likely to be used due to these infrastructure challenges. This is exacerbated by the fact that the implementation of EMR and EHR systems in healthier and wealthier places will only make the health and socio-economic gradients across regions more marked, increasing inequity. To help mitigate this, governments can systematically address the barriers to EMR and EHR implementation that some regions will undoubtedly face—possibly through budgeting—and monitor implementation progress once EMR and EHR systems go live.

It is also vital to consider that keeping shared records may be problematic for migrants or other groups of patients who lack firm legal status (WHO 2019). This is another strong
rationale for comprehensive health data governance frameworks which can be used to clarify under what circumstances—if any—different authorities may access health data, and for what purposes. In the absence of clear rules and proper communication to patients so that they know of and understand these rules, patient trust may not be possible.

Finally, risk management and mitigation are essential given the broad scope and reach of EMR and EHR systems, the sensitivity of the processes and the data involved, and the potential associated financial and human costs. Beyond the concepts of data security and privacy already discussed in the context of data governance, there is also the issue of cybersecurity. A starting point is to assess current maturity of digital security (such as levels of awareness and digital skills, and resources and funding available for digital security) and review digital security policies and regulations in health (such as one-stop shops and resource libraries). Particularly important is to anticipate risks and prepare contingencies to ensure business continuity and recovery (for example, how will medical records be updated and maintained in situations where EMR and EHR systems are not available).

Implementation

Very generally, there are at least four conversion strategies for first introducing a digital health intervention, such as an EHR system, each with different benefits, costs, and associated risks (Laudon and Laudon 2013). In the context of EMR and EHR systems, given their scope and reach, the value of the information that they contain, and the importance of that information in making potentially life-saving decisions, a direct cutover strategy is not advisable. A phased approach strategy, perhaps involving an initial pilot or even a parallel strategy applied to a small area of a country or region, can help build trust among populations and secure buy-in from health care professionals. Indeed, when deciding how to go live with the EMR or EHR system, a key consideration is how the implementation might overburden health workers. Giving health care professionals time to receive training, support to use the system in everyday practice under controlled conditions, and the ability to provide honest feedback and suggest modifications, are all important. Another benefit of a phased approach is that champions, health workers, support staff and trainers who have been involved in an EMR/EHR implementation can advise and support colleagues in other organizations that have yet to implement the system. These can lead to formal and informal networks of stakeholders, who can collaborate and innovate (Fennelly et al. 2020).

As previously mentioned, successful implementation and sustainable use of EMR and EHR systems requires significant resources. The process is long and complex, involves many stakeholders and requires much of their time, and it is likely to take years—if not decades—before many of the more sophisticated EMR/EHR system functionalities become possible in lower resource contexts. Having appropriate budgeting and consideration of financing mechanisms is crucial, with allocations for initial capital expenditures but also appropriate budgeting for costs during implementation and maintenance phases (WHO 2019). If major investments in basic digital building blocks (such as supply of electricity or broadband connectivity) are needed, then naturally these need to be appropriately budgeted (and allocated) given their importance to other digital development objectives.
Table 6  Four conversion strategies when first introducing a digital health intervention

<table>
<thead>
<tr>
<th>Implementation strategies</th>
<th>Risks</th>
<th>Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>The parallel strategy</strong> involves using both the old medical record system (if any) and the new EMR/EHR system in parallel until the new system works as intended.</td>
<td>Lowest</td>
<td>Highest upfront</td>
</tr>
<tr>
<td><strong>The pilot study strategy</strong> involves introducing the EMR/EHR system in a smaller area to understand its costs and consequences and then scale from there.</td>
<td>In-between</td>
<td>In-between</td>
</tr>
<tr>
<td><strong>The phased approach strategy</strong>, which can be used following a pilot, involves introducing the EMR/EHR system one step at a time, scaling up in a staged manner. Stages could include health facilities or regions, medical specialties, or groups of end-users.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>The direct cutover strategy</strong> involves converting from the old medical record system (if any) to the new EMR/EHR system without any sort of backup or contingency, a strategy that can be very risky and could lead to serious costs and unintended consequences.</td>
<td>Highest</td>
<td>Lowest upfront</td>
</tr>
</tbody>
</table>

Source: Based on Laudon and Laudon (2013).

Note: *= The direct cutover strategy is not advisable for EHR implementations.

Cost categories identified in the WHO Guideline include content adaptation (such as decision support algorithms), technology adaptation (software customization), equipment (devices), training (initial and refresher), human resources (user support staff), workflow integration such as periodic review meetings), communication/data exchanges (connectivity), and technology maintenance (for example, license fees). Some of these costs will occur only once in one place while others will be recurrent and multiplied by the number of health care providers implementing the system. A key source of budgeting information is the landscape analysis of public and private resources that can be leveraged in the implementation of EMR and EHR systems. It is important to consider that many health care providers will not have the resources to implement EMR and EHR systems or may not see the benefit of doing so. Financial incentives to promote implementation could be included in the budgeting process. If appropriate to context, incentives could be tied to performance metrics to ensure good value for money (for example, an indicator of meaningful use of EMRs/EHRs could be electronic prescribing).

At this stage, it would be timely to consider partners to help build out the system, potentially through private sector engagement. It is important to consider what type of market strategy for EMR and EHR systems contracting already exists or is planned (See figure 9).
The market strategy can be determined by one strong governance institution that manages most of the contracts, but it can also be liberalized in the sense that different health care institutions manage their own contracts with EMR/EHR system vendors. In other instances, health care providers take on most of the burden of procurement and contracting systems and/or services required to implement EMR/EHR functions (this is more common). The Annex provides considerations for health care providers that are implementing EMR and EHR systems.

Implementing EMR and EHR systems is only the beginning of a journey of continuous improvement and optimization. Monitoring, evaluation, and learning are crucial to ensuring that the system is achieving its intended goals, and not leading to unintended consequences. A first step in this process is determining what success looks like, how it will be measured, and what the key indicators are that need to be collected, potentially for the first time ever. Monitoring and evaluation should then lead to continuous learning and improvement. One perspective that may be of value is that of the learning health system, defined by the United States Agency for Healthcare Research and Quality as a health system in which internal data and experience are systematically integrated with external evidence, and in which knowledge is put into everyday practice.
Key Challenges and Pitfalls

Digital health record systems can be very large and complex, with connections to many other health information systems, registries, platforms, and applications and services. As previously stated, risk management and mitigation are essential given the broad scope and reach of EMRs/EHRs, the sensitivity of the processes and the data involved, and the potential associated financial and human costs. Some of the risks involved in using an EMR or EHR system include security or privacy issues, potential vulnerability to hacking or for data to be lost or destroyed, inaccurate paper-to-computer transmission, treatment error because of an embedded decision support algorithm, temporary loss of productivity, substantial financial investment, and physician burnout (HHS Cybersecurity Program 2022; Ani et al. 2022).

Implementing EMR and EHR systems can also be challenging. It is not uncommon for Governments and health care providers to underestimate human-related barriers (such as a lack of digital skills and training), focusing mostly on financial and technical barriers (Nelson, Cafagna, and Tejerina 2020). While it is crucial to tackle financial and technical barriers to a successful implementation, this is not sufficient. Another challenge is that EMR and EHR systems may be funded by donors, posing a risk in terms of sustainability and scalability (Fritz, Tilahun, and Dugas 2015). It is important to consider options for promoting sustainability and scalability of donor funded EMR and EHR systems (such as training of staff) to help mitigate these inherent risks.

Decentralized or federated countries face unique challenges in designing and implementing national EHR systems. Because responsibilities for health are shared between the central Government and the subnational (regional, municipal, and even metropolitan) Governments, the number of stakeholders involved can be very large. In some countries, central Governments may not be legally able to design and implement a national system and must work with subnational Governments to do so. Without coordination, it is likely that many HISs with distinct medical terminologies and standards, databases and devices will be implemented. This can lead to difficulties in establishing a national EHR. Task Teams should consider carefully all the ways in which the decentralized nature of the health care system may affect EMR and EHR system design and implementation and adjust client expectations, including in terms of timelines and budgets. Special consideration should be given to disparities (such as wealth and health) between all stakeholders involved.

Table 7  Considerations when establishing a national EHR

<table>
<thead>
<tr>
<th>Issues and challenges identified in WHO EHR manual for developing countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Clinical data entry issues and lack of standard terminology.</td>
</tr>
<tr>
<td>▪ Resistance to new software and lack of computer literacy.</td>
</tr>
<tr>
<td>▪ Strong resistance to change by many health care providers.</td>
</tr>
<tr>
<td>▪ High cost of computers and computer systems and funding limitations.</td>
</tr>
</tbody>
</table>

Table 7 Continued...
Table 7  Considerations when establishing a national HER (continued)

<table>
<thead>
<tr>
<th>Issues and challenges identified in WHO EHR manual for developing countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Concern by providers as to whether information will be available on request.</td>
</tr>
<tr>
<td>▪ Concerns raised by health care professionals, patients and the general community about privacy, confidentiality and the quality and accuracy of electronically generated information.</td>
</tr>
<tr>
<td>▪ Quality of electronic health care information and accuracy of data entries.</td>
</tr>
<tr>
<td>▪ Lack of staff with adequate knowledge of disease classification systems.</td>
</tr>
<tr>
<td>▪ Manpower issues: lack of staff with adequate skills.</td>
</tr>
<tr>
<td>▪ Environmental issues: electrical wiring and supply of electricity, amount/quality of space needed for computers, etc.</td>
</tr>
<tr>
<td>▪ Involvement of clinicians and hospital administrators.</td>
</tr>
</tbody>
</table>

Source: Based on Walker, Bieber, and Richards 2005.

Other Resources

EHR in Practice: an independent US resource for physicians and health practice personnel.

European Patient Summary Guidelines.

Development of standard indicators to assess use of electronic health record systems implemented in low-and medium-income countries.

Medical Documentation in Low- and Middle-income Countries: Lessons Learned from Implementing Specialized Charting Software.

Why sub-Saharan Africa lags in electronic health record adoption and possible strategies to increase its adoption in this region.

Barriers and facilitators to health information exchange in low- and middle-income country settings: a systematic review.

Electronic health record system in the public health care sector of South Africa: A systematic literature review.

Open-Source Electronic Health Record Systems for Low-Resource Settings: Systematic Review.

Clinical information system (CIS) implementation in developing countries: requirements, success factors, and recommendations.

Benefits and challenges of EMR implementations in low resource settings: a state-of-the-art review.
Relevant World Bank Case Studies

- Cambodia
- Peru

Relevant External Case Studies


Uruguay’s National Electronic Health Record System: [https://publications.iadb.org/es/implementacion-de-la-historia-clinica-electronica-nacional-de-uruguay](https://publications.iadb.org/es/implementacion-de-la-historia-clinica-electronica-nacional-de-uruguay)

Digital Health Records Implementation Checklist

This checklist is for national and subnational levels; it can be printed as a stand-alone document.

**Assessment of needs and establishing purpose**
- Identify underlying health system challenges/needs that require EMR/EHR system
- Establish a purpose, make consensus and do initial planning

**Assessing the baseline conditions and building blocks**
- Assess digital maturity
- Identify underlying health system challenges/needs
- Conduct a review of the existing medical record system(s)
- Consider the enabling environment, including: Leadership and Governance; Strategy and Investment; Legislation, Policy and Compliance; Workforce; and Standards and Interoperability
- Consider the information and communication technology environment, including: Infrastructure; and Services and Applications

**Purpose and solution design**
- Identify individuals to involve in the design, management, and implementation of EMR/EHR systems; identify owner(s) and key decision-maker(s)
- Determine purpose, geographical and functional scope of EHRs
- Consider basic model for EMR/EHR system architecture
- Establish if/how data will be migrated to new EMR/EHR system
- Promote a health data governance framework
- Identify available EMR/EHR resources (private and public) using a landscape analysis
- Reflect on client/patient outreach and equity considerations
- Keep in mind risk management and mitigation

**Implementation**
- Consider phases in implementation and key milestones
- Examine budgets, financing mechanisms, procurement and contracting arrangements
- Identify indicators for assessing performance and impact, and for evaluating success
- Plan for continuous improvement and optimization
Acknowledgements

This implementation know-how brief was written by Tiago Cravo Oliveira Hashiguchi, Zlatan Sabic, Malarvizhi Veerappan, and Marelize Görgens. It benefited greatly from comments and feedback from Reem Hafez, Paula Giovagnoli, and Lombe Kasonde. The brief was edited by Harriet Stella Blest and graphically designed by Theo Hawkins. The development of the implementation know-how brief series was prepared under the supervision of Malarvizhi Veerappan and Marelize Görgens.

Background on Implementation Know-how Briefs

What is an Implementation Know-how Brief and What is It For?

The World Bank’s Digital-in-Health: Unlocking the Value for Everyone report calls for a new digital-in-health approach where digital technology and data are infused into every aspect of health systems management and health service delivery for better patient outcomes. The report proposes ten recommendations across three priority areas for governments to invest in: prioritize, connect and scale. The Implementation Know-How Briefs serve as practical, implementable extensions to the Digital Health Flagship report. The Implementation Know-How Briefs take a practical approach to discussing a topic with the aim of describing the topic, the key terms and technical considerations, guidance on how to start an operational engagement with clients on the topic, relevant checklists (if applicable), links and places to go for help.

The aim with the Implementation Know-How Briefs is to give Task Teams enough information to figure out how a given topic fits into Health, Nutrition and Population (HNP) investments, and what are the right questions to ask. The aim is not to make Task Teams topic experts. The Implementation Know-How Briefs also tackle the dependencies between different topics.

Who is This Implementation Know-how Brief For?

The Implementation Know-How Briefs are focused on World Bank Task Teams, countries, and other organizations involved in implementation of Digital-in-Health activities and extend the discussion on the topics covered in the Digital Health Flagship report.

Who is Responsible for Implementation Know-How Briefs?

Digital Health Flagship Research Program: digitalinhealth@worldbank.org.
Annex 1  Examples of Digital Health Record Implementation Guides

There are many EMR and EHR implementation guides available, but almost all of them focus on health care providers implementing a specific EMR and EHR system in high-income countries, and not on national and subnational implementations that may involve many providers with multiple EMR and EHR systems in LMICs. Examples are provided below. The only guide that focuses on both providers and governments in LMICs is WHO’s “Electronic Health Records: Manual for Developing Countries” from 2006. Task Teams contemplating which guides and steps to follow should first consider the EMR and EHR scope and functionalities that their clients are interested in.

Examples of digital health record implementation guides

<table>
<thead>
<tr>
<th>Guide/Resource</th>
<th>Overview, focus and purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>**Electronic Health Records: Manual for Developing Countries</td>
<td>World Health Organization, 2006</td>
</tr>
<tr>
<td><img src="image" alt="Electronic Health Records" /></td>
<td></td>
</tr>
<tr>
<td>**Health IT Playbook: Electronic Health Records</td>
<td>United States Office of the National Coordinator for Health Information Technology, last updated in 2019</td>
</tr>
<tr>
<td><img src="image" alt="Health IT Playbook" /></td>
<td></td>
</tr>
<tr>
<td>Examples continued...</td>
<td></td>
</tr>
</tbody>
</table>

Examples continued...
<table>
<thead>
<tr>
<th>Guide/Resource</th>
<th>Overview, focus and purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Electronic Health Records Collection</strong></td>
<td>Designed to support lifelong learning, licensure and certification needs, the American Medical Association (AMA) Ed Hub provides high-quality education for physicians and other medical professionals to stay current and continuously improve the care they provide. Modules typically present information using steps to, among others, help providers decide which EHR software and vendor is best for their practice, help their practice plan for a smooth transition from paper records to an EHR system, and optimize the use of EHRs in their practice. <strong>BEST FOR:</strong> provider-level EHR implementations</td>
</tr>
<tr>
<td><strong>Planning for, Selecting and Implementing Electronic Health Records (EHRs) for Long-Term and Post-Acute Care Solutions Interactive Educational Module</strong></td>
<td>This white paper and the companion EHR Selection Matrix, online Center for Aging Services Technologies (CAST) Electronic Health Records Selection Tool, and case studies provide hands-on tools that help Long-Term and Post-Acute Care providers adopt appropriate aging services technologies. The purpose is to aid aging services organizations in choosing an EHR system that fits the needs of the organization, its providers, and its consumers, patients, and clients. It explains the steps involved in planning for and implementing electronic records, including assessing hardware, software, and staffing needs, and assessing financial resources and sources of funds. <strong>BEST FOR:</strong> EHR implementations in long-term and post-acute care</td>
</tr>
<tr>
<td><strong>EHR best practice resources</strong></td>
<td>EHR in Practice is an independent resource for physicians and health practice personnel, with the aim of providing the latest knowledge, tools and opinion about EHR software. Among the resources included in this directory are: EHR software pricing guide; top EHR software; EHR requirements template; EHR selection checklist; EHR implementation template; EHR software request for proposals guide; EHR software vendor directory; features to look for in EHR software. <strong>BEST FOR:</strong> provider-level EHR implementations, vendor-related guidance</td>
</tr>
</tbody>
</table>

Examples continued...
HIMSS healthcare maturity models, including their flagship model, the EMRAM, provide prescriptive frameworks to healthcare organizations to build their digital health ecosystems. The EMRAM is an eight stage (0-7) model that measures clinical outcomes, patient engagement and clinician use of EMR technology for acute care hospitals and their affiliated ambulatory care settings, aiming to strengthen organizational performance and health outcomes across patient populations. The O-EMRAM is an eight stage (0-7) model that measures the adoption and utilization of EMR functions required to achieve a near paperless environment that harnesses technology to support optimized patient care.

**BEST FOR:** provider-level EHR implementations, hospital focus
Annex 2  Example of a Typical EMR/EHR System Related Theory of Change

Electronic health record systems theory of change

<table>
<thead>
<tr>
<th>Problems in Health Information Systems that EHR approaches can help solve</th>
<th>Electronic Health Record implementation</th>
<th>Outcomes</th>
<th>Longer-term Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ People lack ways to take greater control of their health and communicate with their health care team</td>
<td>▪ Assess baseline conditions and building blocks, including reviewing existing medical record system</td>
<td>▪ Improved health care quality and patient outcomes</td>
<td>▪ Universal and equitable access to affordable, people-centered, and integrated quality care</td>
</tr>
<tr>
<td>▪ Health care providers do not have access to consistent and timely information about their patients to promote appropriate and coordinated care</td>
<td>▪ Determine role of EHR in achieving health system goals and tackling challenges</td>
<td>▪ Improved health system and provider performance and management</td>
<td>▪ Good governance of health systems for sustainable financing and accountability for health outcomes</td>
</tr>
<tr>
<td>▪ Poor or no identification of at-risk and complex population groups, and no targeting delivery of appropriate treatments</td>
<td>▪ Design and develop EHR, including geographical and functional scope, basic architectural model, and possibly data migration</td>
<td>▪ Improved care coordination and information sharing</td>
<td>▪ Augmented service delivery value chain</td>
</tr>
<tr>
<td>▪ Limited data to assess health system performance and identify waste</td>
<td>▪ Promote a health data governance framework</td>
<td>▪ Improved communication and patient engagement</td>
<td>▪ Reinvigorated essential public health functions</td>
</tr>
<tr>
<td>▪ Limited or no data to inform effective responses to public health emergencies</td>
<td>▪ Identify available EHR resources (private and public) using a landscape analysis</td>
<td>▪ Improved collection and overall quality of health data and information</td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ Choose appropriate implementation strategy, tied to budgets and financing mechanisms</td>
<td>▪ Improved health monitoring, surveillance, and research</td>
<td></td>
</tr>
<tr>
<td></td>
<td>▪ Put in place mechanisms for monitoring performance and managing the solution post-implementation</td>
<td>▪ Increased investments and donor funding</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Strengthened collaboration between client countries</td>
<td></td>
</tr>
</tbody>
</table>

**Longer-term**

- Enhanced capacity to develop and execute national digital health strategies
Annex 3  Key Considerations for Health Care Providers

Regardless of provider type (public or private; basic primary, secondary referral, or tertiary/specialist hospitals), there are four key steps to implementing EMR and EHR systems at the health care provider level: planning and preparation; understanding contracts and selecting a vendor, or alternatively developing own system; implementing and using the system; and finally optimizing the system. Each of these steps involves multiple activities and decisions.

During planning and preparation, the key objectives are to understand how EMR and EHR systems will support the organization’s needs and strategic goals, how ready to implement an EMR or EHR system the organization is, what roadblocks will need to be addressed, and what benefits and challenges the organization can realistically expect during implementation. The first step is to conduct a needs assessment to understand current processes and workflows, and to establish goals (Walker, Bieber, and Richards 2005). This is a crucial step in that many of the decisions that follow will tie back to this needs assessment, including, for example, decisions relating to functional requirements and scope of the EMR or EHR system, choice of vendor, stakeholder involvement and ownership, budget, and longer-term vision for extensions. At the end of preparation and planning, it should be clear what infrastructure is already in place and what will be needed, and which workflows (e.g., appointment request, examination request, drug prescription, etc.) will need to be re-designed and how.

Figure A1  key considerations/Steps for providers implementing EMR and EHR systems

1. Planning and preparation:
   Conduct a needs assessment, understand potential benefits and roadblocks, and set realistic expectations

2. Understanding contracts, selecting a vendor or developing own system:
   System should support strategic goals and operational needs; research/compare vendors or open-source options; negotiate contract

3. Implementing and using system:
   Establish a governance process, manage the change, involve users, train staff, migrate data, give staff time to adjust, manage vendor relationship

4. Optimizing the EHR system:
   Assess implementation processes and outcomes, focus on usability, consider extending EMR and EHR access to patients and external providers

The second step involves selecting an EMR/EHR system vendor and negotiating the contract, or alternatively developing an EMR/EHR system in-house, possibly built on an open-source solution using a human-centered design process. A crucial activity is to set the requirements of the EMR/EHR system, based on the assessment conducted in the previous step. There is a wealth of information and guidance for health care providers seeking to select an EMR/EHR vendor and negotiate a contract, but these guides are mostly from high-income countries (see...
Health care providers in LMICs may not have the human and financial capacity to procure and contract out an EMR/EHR system and may instead adopt one of the many open-source solutions that currently exist (Syzdykova et al. 2017). This is not to suggest that developing an open-source EMR/EHR system in-house is less challenging than procuring one from a vendor (certainly would require a team with the right technical skills), but an open-source solution is likely to have lower costs. The following table highlights some of the pros and cons of different system development strategies.

**Table A1  Pros and cons when selecting an EMR/HER vendor**

<table>
<thead>
<tr>
<th>Delivery strategy</th>
<th>Characteristics</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>In-Sourcing</strong></td>
<td>Internal capacities are used for the design, development, maintenance, execution, and/or offer of support for the service.</td>
<td>☺ Direct control ☺ Freedom of choice ☺ Familiarity with internal procedures</td>
<td>☺ Cost and time for delivering services ☺ Dependence on internal resources and competencies</td>
</tr>
<tr>
<td><strong>Outsourcing</strong></td>
<td>Engaging an external organization for the design, development, maintenance, execution, and/or offering of support of the service.</td>
<td>☺ Focus on core competencies ☺ Reducing long-term costs</td>
<td>☺ Less direct control ☺ Unfamiliarity with the skills of supplier</td>
</tr>
<tr>
<td><strong>Multi-sourcing</strong></td>
<td>Multiple organizations make formal agreements with the focus on strategic partnerships (creating new market opportunities).</td>
<td>☺ Expanded market opportunities ☺ Competitive response opportunities</td>
<td>☺ Complexity of projects ☺ “Culture clash”</td>
</tr>
<tr>
<td><strong>Business Process Outsourcing (BPO)</strong></td>
<td>An external organization takes over a business process, or part of one, at a cheaper location (for example, call center).</td>
<td>☺ One-counter functionality ☺ Access to specialized skills</td>
<td>☺ Loss of knowledge ☺ Loss of relationship with the business</td>
</tr>
<tr>
<td><strong>Application Service Provision</strong></td>
<td>Computer-based services are offered to the customer over a network.</td>
<td>☺ Access to complex and expensive solutions ☺ Support and upgrades included</td>
<td>☺ Access only to facilities, not knowledge ☺ “Culture clash”</td>
</tr>
</tbody>
</table>

*Source: Based on Bon 2011.*

In terms of infrastructure, one key decision is whether to implement a locally hosted or cloud-based system. Both have advantages and disadvantages. For example, a locally hosted system can work even when Internet connectivity is not available but has less robust backup, while a cloud-based system can be more cost-effective (e.g., fewer costs with maintenance) but is reliant on a third party. There are guides to assist providers in choosing between a cloud-based, a locally hosted or a hybrid EMR/EHR system (see table A2).
The third step involves implementing the EMR/EHR system and achieving meaningful use. The Inter-American Development Bank (IDB) has identified five key success factors:

1. **Ensure governance**: All the economic, human, legislative, and political resources necessary to support an EMR/EHR system implementation are available.

2. **Form interdisciplinary teams** with an understanding of a range of technologies, information systems, and service delivery processes and models, and when these skills are not available, training programs must be offered.

3. **Plan the change**: Devote about a third of the staff to managing the change and cultural transformation processes; the software is only one component of the change needed.

4. **Government support for change management** through the provision of tools or services that strengthen communication, training, evaluation, and feedback, and the dissemination of documentation of good practices, and sharing of experiences.

5. **Use participatory management techniques**: All actors (including the community) are involved, can detect problems, help prioritize steps, propose improvements, and monitor change, reducing points of resistance and helping all those affected to take ownership.

**Table A2  Toolkits/guides on implementing an electronic health record system at provider level**

**Selecting a vendor, contracting, or developing own system**

- **US ONC, “EHR Contracts Untangled: Selecting Wisely, Negotiating Terms, and Understanding the Fine Print”**: Provides critical planning and negotiation steps to help you understand and communicate your EHR requirements; includes examples of contract language and technical terms.

- **US ONC “Electronic Health Record (EHR) Demonstration Scenario, Evaluation, and Vendor Questions”**: Provides established scenarios to help clinicians and health IT implementers understand vendor capabilities.

- **US ONC “Electronic Health Record (EHR) System Testing Plan”**: Helps track various EHR performance tests.

- **US ONC “Vendor Comparison and Matrix Tool”**: Suggests questions to ask EHR vendors during demos, including how their systems meet Meaningful Use objectives.

- **US ONC “Vendor Pricing Template”**: Defines line-item costs for EHR software, implementation, training, and support, for both on-site licensing models and cloud-based platforms. A helpful tool that provides a framework for comparing costs among prospective vendors.

- **US ONC “Workflow Redesign Templates for EHR Implementation”**: Provides guidelines for workflow process mapping to help optimize EHR efficiency.

- **American Medical Association’s “Electronic Health Record (EHR) Software Selection and Purchase”**: this 6-step module helps decide which EHR software and vendor is best for a specific practice.

- **LeadingAge’s “Planning for, Selecting and Implementing Electronic Health Records (EHRs) for Long-Term and Post-Acute Care Solutions – Interactive Educational Module”**

*Table continued...*
Table A2  Toolkits/guides on implementing an electronic health record system at provider level (continued)

## Implementing and using the system

- **US ONC “Change Management in EHR Implementation”**: Explains basic change-management principles and discusses the importance of managing change effectively during EHR implementation.
- **US ONC “Chart Migration and Scanning Checklist”**: Provides guidelines on what paper-record information is needed to import into an EHR system.
- **US ONC “Creating a Leadership Team for Successful EHR Implementation”**: Helps create a leadership team and describes important roles and responsibilities; includes a template to use during the process.
- **US ONC “Defining Goals and Objectives for EHR Implementation”**: Helps establish realistic, measurable goals for an EHR implementation.
- **US ONC Change Package for Improving EHR Usability**: A toolkit with strategies, resources, and case studies to help mitigate EHR usability issues while optimizing the use of health information technology.
- **American Medical Association’s “Electronic Health Record (EHR) Implementation”**: this 9-step module can help a practice plan for a smooth transition from paper records to an EHR system.

## Optimizing the system

- **American Medical Association’s “Electronic Health Record Optimization”**: 8 steps for optimizing the use of EHRs in a practice.
- **Data.FI “Optimizing Electronic Medical Records”**.

### Source:
United States Office of the National Coordinator for Health Information Technology, American Medical Association, LeadingAge and Data for Implementation (Data.FI). LeadingAge also provides “lessons learned”.

During implementation, problems are likely to arise. Even though vendor or system selection should have included some level of usability testing, there may still be new problems that are only apparent once the system is used in real-world everyday practice. This is to be expected with a large information system such as an EMR/EHR system. Working with all the stakeholders affected, the interdisciplinary implementation team can find solutions to the problems and implement them. This is why a phased implementation is advisable.

Finally, the fourth step is to optimize use of the EMR/EHR system, and eventually potentially replace it. This is the moment to take stock of the implementation process, tease out any remaining problems in how the system is being used, and plan for improvements in usability and workflow. Having a culture of continuous improvement is recommended.
References


Health Information and Quality Authority. 2018. "Patient Summary Information Requirements.”


Notes


5 See OpenHIE webpage available from https://ohie.org/.

6 MEASURE Evaluation’s Health Information Systems Interoperability Maturity Toolkit can be accessed from https://www.measureevaluation.org/resources/tools/health-information-systems-interoperability-toolkit.html.


8 According to HIMSS (see https://www.himss.org/resources/interoperability-healthcare), there are three primary types of exchange network architecture used to coordinate the exchange of health information across entities. In the centralized model, patient data are collected and stored in a centralized repository, data warehouse or other databases. The exchange organization has full control over the data, including the ability to authenticate, authorize and record transactions among participants. In a federated or decentralized model, interconnected but independent databases allow for data sharing and exchange, and grant users access to the information only when needed. The hybrid mode incorporates variations of federated and centralized architectures to harness the advantages of both.
