

Mapping of Digital Health Tools and Technologies: **Oman Country Brief**

May 2022



Mapping of Digital Health Tools and Technologies:

Oman Country Brief

May 2022

Joint regional mapping of digital health tools
and technologies for Reproductive, Maternal,
Newborn, Child and Adolescent Health

WHO EMRO

UNFPA ASRO

UNICEF MENARO

Table of Contents

Abbreviations and Acronyms	4
Overview	6
Introduction	6
Methodology and Analysis Overview	7
Digital Health Tools and Technologies	9
Al-Shifa	9
The e-Referral system	11
Centres of Disease Control Information System	12
Incident reporting system	12
Oracle Health Management System	13
The Central Birth and Death Registry	14
Nabdah Al-Shifa	15
e-notification system (Tarassud)	15
National eHealth Registry	16
National Blood and Donation Registry	16
Auxiliary tools	17
Enabling Environment	19
Infrastructure	19
Leadership and Governance	19
Legal Framework for Data Protection and Security	19
Laws or Regulations for Privacy, Confidentiality, and Access to Health Information	19
Mechanism to monitor/ measure the implementation of digital solutions on RMNCAH including specific indicators	19
The Way Forward	20
Acknowledgments	20
Appendix: Use Case Definitions	22
Additional Resources	25

Abbreviations and Acronyms

ANC	Antenatal Consultation
CHW	Community Health Worker
CO	Country Office
COD	Common Operational Datasets
CRVS	Civil Registration and Vital Statistics
DHA	Digital Health Atlas
DIAL	Digital Impact Alliance
DICE	Digital Health Center of Excellence
DIIG	Digital Implementation Investment Guide
EIR	Electronic Immunization Record
EMR	Electronic Medical Record
FHW	Frontline Health Worker
HF	Health Facility
HMIS	Health Management Information System
INGO	International Non-governmental Organization
LMIS	Logistics Management Information System
MOH	Ministry of Health
NGO	Non-governmental organization
NICU	Neonatal Intensive Care Unit
RCCE	Risk Communication and Community Engagement
RMNCAH	Reproductive, Maternal, Newborn, Child, and Adolescent Health
RO	Regional Office
SDG	Sustainable Development Goals
UN	United Nations
UNFPA	United Nations Population Fund
UNICEF	United Children's Fund
USAID	United States Aid
WB	World Bank
WHO	World Health Organization

Overview

Introduction

Since the 1970s, Oman has been making very significant achievements in ensuring health for all, being one of the first countries in the world to reduce the under-5 mortality rate by two-thirds during the 1980s¹. The Ministry of Health (MOH) is the primary healthcare provider in the country, Governorates Health Sectors and private clinics also exist. Oman, in 2014, published the Health Vision 2050² which serves as the main roadmap for developing the healthcare sector in the country for the next two decades and which is well aligned with Sustainable Development Goals (SDGs). In regards to digital health, Oman, in the 1990s, started to develop its own health management information system (HMIS), which is currently called “Al-Shifa” and has been constantly updated and greatly integrated throughout all the layers of the healthcare system, making it the main and in most instances the only system for multiple use cases³.

The current COVID-19 pandemic has only more acutely brought forth the urgency of the presence of a strong and integrated digital health ecosystem. It has also brought forth the urgency of the presence of a strong and integrated digital health ecosystem because this pandemic has necessitated the use of alternative mechanisms for delivering essential Reproductive, Maternal, Newborn, Child, and Adolescent Health (RMNCAH) and reaching the affected populations. The need to reduce unnecessary face-to-face contact with health care providers and the increased demand for many innovations that could offer safer and better-quality health services has been increasing.

From the perspective of RMNCAH, the aim of this mapping is to chart and review the situation on the use of digital solutions in RMNCAH program implementation, utilization, and provision of RMNCAH services and its enabling environments such as digital health infrastructure in the member states of the World Health Organization (WHO) Eastern Mediterranean Region (also including countries covered by United Nations Population Fund (UNFPA) Arab States Regional Office) and UNICEF Middle East and North Africa Regional Office and to find about opportunities for effective adoption, integration, and scale-up of digital solutions in RMNCAH so that women, mothers, newborn babies, children, and adolescents can reach and utilize essential RMNCAH services and health care providers can provide those services effectively and efficiently while they protect their own safety in the context of COVID-19 and beyond. Following this overview, this report presents the digital health tools that are in use in Oman with details of their usage and scale, and, where available, information about implementing agencies, donors, etc; briefly presents the enabling environment for digital health in Oman; a proposed path forward; and a word of acknowledgement. The report concludes with appendices that provide additional resources and information.

¹ <https://apps.who.int/iris/handle/10665/42281>

²

<https://www.moh.gov.om/documents/16506/119833/Health+Vision+2050/7b6f40f3-8f93-4397-9fde-34e04026b829>

³

https://www.researchgate.net/publication/273521144_Al-Shifa_Healthcare_Information_System_in_Oman_A_Debatable_Implementation_Success_accepted_in_The_Electronic_Journal_of_Information_Systems_in_Developing_Countries

Methodology and Analysis Overview

A joint regional questionnaire for mapping has been developed based on the UNICEF Digital Health Mapping tool, WHO AFRO “Understanding the use of digital health for mitigating the effects of COVID-19 on continuity of essential SRMNCAAH services” and Global Digital Health Index.

The main sources of information are the personnel working at each WHO/ UNFPA/ UNICEF country office along with other main actors and champions in the field of digital health in the country including the Ministry of Health. The questionnaire has been sent out from UNICEF MENARO focal point on behalf of three organizations to the country focal points (RMNCAH and digital health). At the country level, one focal point should be assigned as a team lead to follow up the process. The country office colleagues communicate internally and among the organizations before jointly reaching out to the Ministry of Health about this mapping. The county could choose 1) doing an online interview with all relevant stakeholders (UNICEF HQ and MENARO conduct the interview), 2) filling out the questionnaire by all relevant stakeholders using a face-to-face meeting (including relevant technical working group) or 3) filling out the questionnaire shared online. The content should be answered, reviewed and endorsed by the Ministry of Health, WHO, UNFPA, UNICEF, and other relevant stakeholders in the country.

Oman opted for option 3) and the self-assessment questionnaire was filled out by colleagues at the Ministry of Health from January through March 2022. The information gathered was supplemented primarily with data from the [comprehensive assessment of Oman's health information system done in 2019 by WHO EMRO](#) and (when available) from the World Bank's Digital Health Landscaping assessment, the [Map & Match exercise](#) by Digital Square, the [Digital Health Atlas](#) (DHA), [INVENT](#), and the [Digital Impact Alliance \(DIAL\) Catalog of Digital Solutions](#). The collated data was entered in the [Mapping of Digital Health Tools and Technologies tool](#).

There are 10 digital health implementations currently being used in Oman and all of them are implemented at the national level. Although none of them is considered [global digital public goods](#), the tools are built, particularly Al-Shifa, open-source and based on internationally recognized, healthcare interoperability standards (HL7 FHIR).

Strengths

- There is a strong commitment from Oman's MOH to continue to invest in their health management information system and the digital health ecosystem at large.
- The sultanate of Oman has a clear vision and roadmap to continue to develop its digital health ecosystem in a comprehensive and well-coordinated manner.
- The Al-Shifa system is well-positioned to be deployed in other countries (particularly neighbouring countries) due to its robust architecture, the use of international interoperability standards, and the fact that is open source.

Gaps

- It is acknowledged that the mapping tool reflects the knowledge of the stakeholders included in the interview(s) and/or self-assessment questionnaire and may be excluding systems not known to them. It would be imperative to engage with all organizations operating in the health space for a more comprehensive view.

Opportunities

- Consider disseminating the experiences of Oman to other countries, especially in the East Mediterranean/ Arab States/ Middle East and North Africa region.
- Continue to consider the potential advantages of adopting systems that are considered global digital public goods as new tools are being implemented and the possibility of nominating Al-Shifa as a digital public good.
- Continue to invest in human resources capacity and infrastructure.
- Foster coordination with other UN agencies, INGOs, and entities engaged in digital health interventions as well as with the MOH to ensure a more comprehensive mapping of the digital health ecosystem

Digital Health Tools and Technologies

National	Subnational
<ul style="list-style-type: none"> • Al-Shifa • The e-Referral system • Centres of Disease Control Information System • Incident reporting system • Oracle Health Management System • The Central Birth and Death Registry • Nabdh Al-Shifa • e-notification system (Tarassud) • National eHealth Registry • National Blood and Donation Registry 	

Digital Health Tool	Al-Shifa
<p>Description</p> <p>AI-Shifa is a comprehensive and integrated health care management information system developed as a complete solution for health care facility management from electronic medical records to assets, inventory, and human resources management. The system was fully developed locally by the Ministry of Health. In 2019, the system was installed in more than 220 health care facilities of varying sizes and capabilities, including several non-Ministry of Health caregiver facilities.</p> <p>The system was developed in 1999 and has evolved over the years; the latest version was released at the end of 2020. The new structure is useful in redeveloping AI-Shifa system modules using new web technology. It is also an open-source, Java-based system.</p> <p>AI-Shifa is a fully integrated and easily accessible electronic medical record that provides a 360-degree view of the patient's history, and clinical information needed at point-of-care is the most crucial component of the system. It captures all aspects of patient information that have clinical significance, right from patient referral/walk-in to the health care facility to discharge from the facility after the required care is delivered to the patient through a set of in- and out-patient services.</p> <p>AI-Shifa uses the national/civil identification (ID) number as a unified ID number for each patient. The system is compulsory, however, it is not widely implemented across all sectors and facilities. The private sector needs to discuss the feasibility of getting access to the system. Also, there are other medical institutions such as those related to the Royal</p>	

<p>Oman Police Medical services, the Armed Forces Medical Services, the medical services of Diwan Royal Court, and Sultan Qaboos University Hospital which utilize different software/platforms.</p>	
<u>Current Use Case(s)</u>	Health Management Information System (HMIS), Electronic Medical Record (EMR), Community Based Information System, Laboratory and Diagnostics Information Systems, Pharmacy Information System, HIV Registry, Logistic Management Information Systems (LMIS), Track and Trace System, Immunization Stock Forecasting, Cold Chain Monitoring, Cold Chain Equipment Monitoring, Telemedicine, Public Health and Disease Surveillance System, Immunization Delivery Monitoring, Civil Registration and Vital Statistics (CRVS), Patient Registry, Health Worker Registry, Digital Yellow Card, Electronic Immunization Records, Master Facility Registry, Data Visualization, Analytical Modeling
Scale	National
Implementer(s)	MOH
Donor(s)/Funding Source	MOH
Licensing	Open Source
Website	https://omanuna.om/en/home-top-level/whole-of-government/central-initiative/al-shifa
Covid-19 Specific Functions	-
RMNCAH Functions	<p>RMNCAH indicators are collected on an ongoing basis.</p> <p>The following indicators are collected through the HMIS:</p> <ul style="list-style-type: none"> ● Number of live births ● Maternal Mortality Ratio/ Number of Maternal deaths ● Number of pregnant women and adolescent girls who attended 1st ANC ● Number of pregnant women and adolescent girls who attended 4th ANC ● Number of total deliveries ● Number of delivery with cesarean section ● Neonatal mortality rate/number of newborn deaths ● Number of newborns who received early postnatal care in first 48 hours ● Number of newborns who are admitted to NICU ● Under-five mortality rate/ number of under-five deaths ● Number of children under 5 with diarrhoea who received treatment according to national guidelines ● Number of children under 5 diagnosed with pneumonia that were treated with amoxicillin <p>The following indicators are collected through the EMR:</p> <ul style="list-style-type: none"> ● Family planning ● Screening for sexually transmitted infections

- Treatment for sexually transmitted infections
- Antenatal Care
- Spontaneous Delivery
- Caesarean section
- Postnatal Care
- Admission to neonatal intensive care unit
- Immunization
- Treatment for communicable diseases for under-five children (Acute Respiratory Infections and Treatment for diarrhoea)

The following information is part of the Health Worker Registry:

- Obstetrician/ Gynecologists
- Paediatrician
- Midwife
- Nurse
- In-service trainings

The following information is part of the Electronic Immunization Record:

- Information related to RMNCAH (e.g. delivery history, breastfeeding information, etc.)
- A system to track and trace pregnant women whether she is receiving ANC services
- A system to track and trace under-five children on immunization
- A system to track and trace under-five children on well-child check-up

Digital Health Tool	The e-Referral system
Description	The e-Referral system was developed to refer or transfer patients electronically from one institution to another in order to promote continuity of care. At present 220+ health care institutions across Oman are interconnected, taking care of inter-institutional appointment requests for inpatient/ambulatory services, laboratory, radiology and other procedures and for transferring relevant clinical data to and from the institutions requesting and providing services. The referrals get uploaded to referral centres with automatically attached HL7 Clinical Document Architecture (HL7-CDA) compliant documents. When appointments are realized, SMS alerts are sent to patients. Subsequently, the patient encounters at the referred institutions are tracked and consultation feedback is automatically sent back to the referring institutions, enabling the sender to track developments. For the laboratory, radiology and procedure referrals, results/ reports are sent back online to the sender upon completion of the service and authorization of the reports.
Current Use Case(s)	Electronic Medical Record (EMR)
Scale	National
Implementer(s)	MOH
Donor(s)/Funding Source	MOH

Licensing	-
Website	-
Covid-19 Specific Functions	-
RMNCAH Functions	-

Digital Health Tool	Centres of Disease Control Information System
Description	The Centres of Disease Control Information System builds a central information system for all the centres of disease control, which is also integrated with other government entities such as the Ministry of Manpower and the Royal Oman Police who collaborate in the recruitment of the expatriate workforce to the country. The integration entails the employment clearance information and the eventual upload of the screening status at the end of the process. The system will also be linked to the visa application and the National Records System in order to update it regarding the fitness status of employees after the screening. The Centres for Disease Control Information System also manages the work flow within each centre from the registration of the applicant, through the clinical process involved in the screening vaccinations and laboratory/radiological investigations and ending with the clearance of fit employees for the assigned jobs.
Current Use Case(s)	Public Health and Disease Surveillance System
Scale	National
Implementer(s)	MOH
Donor(s)/Funding Source	MOH
Licensing	-
Website	-
Covid-19 Specific Functions	-
RMNCAH Functions	-

Digital Health Tool	Incident reporting system
Description	The Incident reporting system is a significant step forward for patient safety efforts, facilitating a more proactive approach to medical errors and other unanticipated incidents. The real-time event reporting system protects the anonymity and impunity of the reporters and then uses the reports to identify the cause of unexpected incidents and propose solutions to mitigate them, reduce their frequency, and/or avoid them

altogether. While the reported adverse incident is being discussed between the stakeholders and experts, real-time feedback should be given to the incident reporters.

The centralized system also facilitates the transmission of details to quality and patient safety administrators without compromising the confidentiality of the data and institutional safeguards. The system should also provide timely performance characteristics and indicators so that performance goals can be setup to improve the quality of service. At the facility level, a nurse manually registers and updates the patient information in the disease registers and assists the physician in entering the information into Al-Shifa. Currently, in some health facilities, registration still uses the patient's facility ID number. However, the national unique civil ID number is recorded into the electronic system for all patients, although duplicates are sometimes identified.

Current Use Case(s)	Public Health and Disease Surveillance System
Scale	National
Implementer(s)	MOH
Donor(s)/Funding Source	MOH
Licensing	-
Website	-
Covid-19 Specific Functions	-
RMNCAH Functions	-

Digital Health Tool	Oracle Health Management System
Description	Oracle Health Management System is a flexible and comprehensive solution for monitoring and improving public health during outbreaks of community diseases.
Current Use Case(s)	Immunization Forecasting
Scale	National
Implementer(s)	MOH
Donor(s)/Funding Source	MOH
Licensing	Proprietary
Website	https://docs.oracle.com/en/industries/health-sciences/health-management/

Covid-19 Specific Functions	-
RMNCAH Functions	-

Digital Health Tool	The Central Birth and Death Registry
Description	<p>The Central Birth and Death Registry is an emerging computerized nationwide birth and death registry wherein all vital events happening within or reported to health care facilities (public and private) are recorded into a single registry. The system is built using open standards and architectures so that disparate electronic medical records systems and other client-server software may connect to the system in a platform-independent way and deliver standard messages related to birth and death events occurring within the care facility. The system is also integrated with the Royal Oman Police National Civil Registration System, which means the records delivered to the Ministry of Health registry are also routed to the Royal Oman Police National Records System registry online. The two-way link established between the Royal Oman Police and the Ministry of Health helps to automate the exchange of birth notifications with the National Records System and the health institutions to obtain the national ID of the registered neonates when the birth certificate is issued at the National Records System at a later stage.</p> <p>This programme was developed by the Directorate General of Information Technology in collaboration with the Directorate General of Planning and Studies. The birth registration form is recorded by the hospital nurse and the death notification form is filled in by a physician/doctor. The form is reviewed and authorized by the hospital registrar. Birth and death records are automatically routed to the Royal Oman Police National Records System with data validations. Ministry of Health administrators can review and approve the birth and death records and view the related comments. Among other things, the Central Birth and Death Registry and associated application programming interfaces enable users to record, search, list and modify records based on user access. It also has a web services interface to allow the Al-Shifa platform to deliver birth and death messages, and query, list and update the existing records.</p>
	<p>More information about the system can be found here.</p>
<u>Current Use Case(s)</u>	Civil Registration and Vital Statistics (CRVS)
Scale	National
Implementer(s)	MOH
Donor(s)/Funding Source	MOH
Licensing	Open source
Website	https://cbdr.moh.gov.om/#/

Covid-19 Specific Functions	-
RMNCAH Functions	-

Digital Health Tool	Nabdah Al-Shifa
Description	Nabdah Al-Shifa is an electronic system that was developed internally by the Directorate General of Information Technology using artificial intelligence analytics to display interactive statistical dashboards to enhance data visualization at the national level using data from Al-Shifa.
Current Use Case(s)	Data Visualization
Scale	National
Implementer(s)	MOH
Donor(s)/Funding Source	MOH
Licensing	-
Website	-
Covid-19 Specific Functions	-
RMNCAH Functions	-

Digital Health Tool	e-notification system (Tarassud)
Description	e-Notification was developed to build central repositories for certain communicable and noncommunicable disease notifications, so individual institutions can notify such events and the central bodies responsible for quality control and follow-up can monitor, classify and report back follow-up actions. The system was later extended to handle a broad range of notifications such as adverse events and trauma
Current Use Case(s)	HIV Registry, Disease Registry
Scale	National
Implementer(s)	MOH
Donor(s)/Funding Source	MOH
Licensing	-
Website	-
Covid-19 Specific	-

Functions	
RMNCAH Functions -	
Digital Health Tool	National eHealth Registry
Description	The National eHealth Record project is a part of strategic decision to build an interoperable health IT ecosystem in the country which will become a platform for health care data sharing among multiple stakeholders. The National eHealth Record ecosystem depends on the shared clinical repository based on the HL7-FHIR standard along with web and mobile user interfaces which reflect the complete patient record. Eventually the NEHR will extend to a personal health record. The expectation is that the system is envisaging both public and private health care providers will share clinical information based on HL7-FHIR standards. Since sharing information is the primary requirement, a scalable messaging architecture is the principal component of the NEHR system
Current Use Case(s)	Electronic Medical Record (EMR), Interoperability Standard, Clinical Repository
Scale	National
Implementer(s)	MOH
Donor(s)/Funding Source	MOH
Licensing	-
Website	-
Covid-19 Specific Functions	-
RMNCAH Functions	-

Digital Health Tool		National Blood and Donation Registry
Description		The National Blood and Donation Registry integrates the different blood banks within Oman to build a central donor and donation registry, a blood product inventory and a transfusion database so that a safe blood donation and transfusion environment can be achieved nationwide. The individual blood bank systems are integrated to the National Blood and Donation Registry bi-directionally, and will make use of the central registry for donor, donation, transfusion and inventory management. All the transactions relating to donor registration and screening, donation and bleeding, blood product creation and screening, blood product issue and transfusion monitoring will be reported to the central registry which then will aid other blood banks to retrieve crucial information and provide necessary checks and alerts during the processes to ensure donor and

recipient safety. All registered donors and donations are available to the blood bank immediately and this repository will also keep track of the donation and screening records and changing status of the donor, whether active or deferred. The Registry keeps all the crucial donor attributes such as demographic/contact details, blood products details, donor status, donation details and dates so that a set of donors can be contacted quickly during emergency situations. The National Blood and Donation Registry helps the blood banks to run donation camps anywhere, which helps to register new donors and upload donor health screening and bleeding information and blood product registration.

<u>Current Use Case(s)</u>	Registry
Scale	National
Implementer(s)	-
Donor(s)/Funding Source	-
Licensing	-
Website	-
Covid-19 Specific Functions	-
RMNCAH Functions	-

Auxiliary tools

Digital Health Tool	National ID
Description	The Sultanate's national ID program started in 2006 and has reached 100% of its population. Every citizen and resident with an ID card also has his/her unique civil number. The smart ID cards enable the Sultanate of Oman to provide secure public services to its population. Oman's national smart ID card and resident card, the size of a credit card, is, first of all, a personal identity card. It can also integrate a driver's license (visually printed as well on the back of the card), an e-purse for payment, and a digital signature.
<u>Current Use Case(s)</u>	National ID
Scale	National
Implementer(s)	Sultanate of Oman
Covid-19 Specific Functions	-

Tool	Common Operational Datasets (COD)
------	-----------------------------------

Description	CODs are authoritative reference datasets used to support operations and decision-making in the initial response of humanitarian emergencies as well as to enable activities such as microplaning. Frequently collected and used CODs are geographical shapefiles, health facility catchment areas, settlements, population estimates, satellite imagery, and ancillary geospatial layers.
Current Use Case(s)	Common Operational Datasets
Scale	National
Access to CODs	Oman's CODs

Digital Health Tool	SMS Shortcode
Description	A short code is a special telephone number designed for high-throughput, two-way messaging. Short codes are used to send and receive SMS and MMS messages to and from mobile phones.
Current Use Case(s)	Core Mobile Services
Scale	National
Implementer(s)	MOH
Covid-19 Specific Functions	Core mobile services can be used by governments and MOHs for a variety of purposes related to COVID-19 such as to provide health advice; where to access care, testing, and vaccination; get COVID-19 test results back, etc. Currently, the government of Mongolia is using it for COVID-19 vaccination.

Tool	TV and Radio
Description	TV and radio used for health messaging and/or risk communication and community engagement. Also used for community health worker training.
Current Use Case(s)	Traditional Media, RCCE
Scale	National
Implementer(s)	MOH

Enabling Environment

Infrastructure

- In Oman, stable supply of electricity is ample. There is also good and stable connectivity to the internet. Smartphones are available for the majority of the population.

Leadership and Governance

- Oman has a digital health strategy, “[Health Vision 2050](#)”, which is nested within the overall health strategy for the country. Moreover, there is a strong commitment to developing a comprehensive eGoverment which integrates with the digital health ecosystem of the country.

Legal Framework for Data Protection and Security

- Oman has laws and mechanisms to ensure privacy and security of information. The law can be accessed [here](#).

Laws or Regulations for Privacy, Confidentiality, and Access to Health Information

- There are also laws to protect individual privacy, governing ownership, access and sharing of individually identifiable digital health data, which can be accessed [here](#).

Mechanism to monitor/ measure the implementation of digital solutions on RMNCAH including specific indicators

- The SCORE report from WHO provides information on RMNCAH indicators with a focus on optimizing data use. It can be read [here](#).

The Way Forward

Oman has been implementing 10 digital health tools under a strong leadership of the government. All the tools are implemented at the national level. The mapping exercise explores a part of seven key categories of the enabling environments for digital health recommended by the Global Digital Health Index: Leadership and governance, Legislation, Policy, and Compliance, and Infrastructure (Figure 1). For “Leadership and Governance”, the Government of Oman is taking a strong leadership with a clear vision and roadmap to continue to develop its digital health ecosystem in a comprehensive and well-coordinated manner. For “Legislation, Policy and Compliance”, laws and regulations are available for Data Protection and Security and also for Privacy, Confidentiality, and Access to Health Information. The government has been investing in developing Al-Shifa which is a comprehensive and integrated healthcare management information system developed as a complete solution for healthcare facility management from electronic medical records to assets, inventory, and human resources management. It is also an open-source, Java-based system to allow interoperability with other digital health tools.

Al-Shifa system addresses a wide range of health system challenges and also covers various thematic areas including RMNCAH such as a) RMNCAH indicators are included in Health Management Information System, b) RMNCAH services are a part of in Electronic Medical Record,c) Human Resources for Health for RMNCAH (including nurses, midwives, obstetricians and paediatricians) are registered in Health Worker Registry, and d) information related to RMNCAH and track and trace of children are a part of the Electronic Immunization Record. During the COVID-19, digital health tools, especially telemedicine helplines, have been mobilised to maintain essential RMNCAH services including antenatal care, child care and immunization.

Oman is one of the excellent examples in the region of how digital health is evolved based on locally developed digital health tools with strong government leadership, vision and roadmap.

Figure1. Key seven categories of the enabling environment



Table 1. Health system challenges possibly addressed by digital health tools

Health system challenges	Digital health tools	Levels of implementation
Information	Al-Shifa (HMIS/ EMR/CBIS/Laboratory and Diagnostics Information Systems/ Pharmacy Information System/HIV Registry/LMIS/ Track and Trace System/Immunization Stock Forecasting/ Cold Chain Monitoring/Cold Chain Equipment Monitoring/ Public Health and Disease Surveillance System/Immunization Delivery Monitoring/CRVS/ Patient Registry/ Health Worker Registry/ Digital Yellow Card/ Electronic Immunization Records/ Master Facility Registry/Data Visualization/Analytical Modeling) e-Referral system (EMR) Centres of Disease Control Information System Oracle Health Management System The Central Birth and Death Registry e-Notification National eHealth Registry (EMR) National Blood and Donation Registry National ID Common Operational Datasets Nabdhi Al-Shifa (Data visualisation)	National National National National National National National National National National National National National National National National National
Availability	Al-Shifa (Health Worker Registry LMIS/Pharmacy Information system/Immunization stock forecasting>	National
Quality	Al-Shifa (Telemedicine) Incident reporting system	National National
Acceptability	Social monitoring through National Centre for Statistics and Information Platform	National
Utilisation	Al-Shifa (Telemedicine)	National
Efficiency	Al-Shifa(Master facility registry/Patient registry/Health worker registry> e-Referral system (EMR)	National
Cost		
Accountability	Incident reporting system	National

Table 2. Thematic areas and use of digital health tools

Thematic areas	
RMNCAH	Al-Shifa (RMNCAH indicators in HMIS, RMNCAH services in EMR, HRH for RMNCAH in Health Worker Registry, information related to RMNCAH and track and trace of children in Electronic Immunization Record)
Communicable diseases	Al-Shifa (HIV Registry/Track and Trace System/ Public Health and Disease Surveillance System)

	Oracle Health Management System e-Notification
Immunization	Al-Shifa (Immunization stock forecasting/ Cold chain monitoring/Cold chain equipment inventory/ Digital Yellow card/Electronic Immunization Records) Centres of Disease Control Information System
Public Health Emergency & humanitarian emergencies	Al-Shifa (Public Health and Disease Surveillance System) Common Operational Datasets (Humanitarian emergencies response)
Risk Communication and Community Engagement	Al-Shifa

Acknowledgments

This brief is a collaborative work of the WHO Regional Office for the Eastern Mediterranean, the UNFPA Arab States Regional Office and UNICEF Headquarter and Regional Office for the Middle East and North Africa. We extend our most sincere gratitude to the Ministry of Health and the Country Offices of three organizations for their contribution to and collaboration on this document.

In addition to this, recently UNICEF and the World Health Organization (WHO) have co-founded the COVID-19 [Digital Health Center of Excellence \(DICE\)](#) to provide coordinated, standardized support and technical assistance to national governments and partners on digital health implementations and solutions, including COVID-19, COVID-19 vaccine delivery, and beyond. If you would like to request support from the DICE, please write to contact@digitalhealthcoe.org.

Appendix: Use Case Definitions

Use Case	Description
Civil Registration and Vital Statistics (CRVS)	Digital systems used to record statistics on vital events, such as births, deaths, marriages, divorces and fetal deaths
Cold Chain Equipment Inventory	Technology to continually keep track of cold chain equipment status (inventory and working status)
Cold Chain Monitoring	Technology to continually monitor temperature-sensitive products being transported in a “cold chain”—that is, a supply chain of perishable and/or temperature-sensitive
Common Operational Datasets	Authoritative reference datasets needed to support operations and decision-making for all actors in a humanitarian response.
Community Based Information System (CBIS)	Family-centered health information system designed for CHWs to manage their work in educating households and delivering an integrated package of promotive, preventive, and basic curative health services
Comorbidity Registry	The presence of comorbidities can significantly affect a patient's treatment options, quality of life, and survival. Comorbidity registries keep track of comorbidities which help inform medical decisions
Contact Tracing	Contact tracing is the process of identifying all people that a positive patient has come in contact with
Core Mobile Services	Services used by GSM cellular phones (feature phones) (SMS Aggregator, SMS Shortcode, IVR Shortcode, USSD Services)
Data Visualization	Digital tools used for graphical representation of information and data
Digital Yellow Card	Digital credentialing for vaccinations
Electronic Medical Record (EMR)	Electronic record for patients - includes information about a patient's health history, such as diagnoses, medicines, tests, allergies, immunizations, and treatment plans
Geographic Information System	Framework for gathering, managing, and analyzing data
Health Management Information Systems (HMIS)	Data collection system to support planning, management, and decision making in health facilities and organizations. It can provide reliable and timely info on health system performance
Health Worker Registry	A registry of all the health workers in the country
Immunization Delivery Monitoring	Digital tools that are used for vaccine handling, distribution, and tracking of vaccines
Immunization Forecasting	The Immunization Calculation Engine (ICE) is an immunization evaluation and forecasting system, whose default immunization schedule supports all routine childhood, adolescent, and adult immunizations. ICE evaluates a patient's immunization history and

	generates the appropriate immunization recommendations for patients
Immunization Stock Forecasting	System or platforms that can forecast vaccine orders based on utilization which can enable COs to identify risks of stock outs or overstocking and take action before they occur
Interactive Voice Response (IVR)	Automated phone system technology that allows incoming callers to access information via a voice response system of pre-recorded messages
Laboratory and Diagnostics Information Systems (LDIS)	Software system that records, manages, and stores data for laboratories and can send laboratory test orders to lab instruments, tracking those orders, and then recording the results
Logistics Management Information System (LMIS)	System of records and reports used to aggregate, analyze, validate, and display data (from all levels of the logistics system) that can be used to make logistics decisions and manage the supply chain. Includes stock on hand, losses and adjustments, consumption, demand, issues, shipment status, and information about the cost of commodities managed in the system
Master Facility Registry	Comprehensive repository of health facilities of the country - would include all admin information and the status of the facility, staff, CCes, etc.
Mobile Community Health Worker Learning Management System (CHW LMS)	Learning management systems functioning in the country for community health workers
National ID	Digital national identity systems
Patient Registry	A patient registry is an organized system that uses observational study methods to collect uniform data (clinical and other) to evaluate specified outcomes for a population defined by a particular disease, condition, or exposure, and that serves one or more predetermined scientific, clinical, or policy purposes.
Pharmacy Information System	Supports the distribution and management of drugs, shows drug and medical device inventory, and facilitates preparing needed reports
Public Health and Disease Surveillance	Contributes data and information to assess and characterize the burden and distribution of adverse health events, prioritize public health actions, monitor the impact of control measures, and identify emerging health conditions that may have a significant impact upon population health
RapidPro	RapidPro is a software product that allows you to visually build the workflow logic for running mobile-based services. This software includes features for managing your users' contacts dynamically, graphically analyzing the data your service receives, connecting to multiple communication channels (ie SMS, voice, USSD, and social media), sending messages in multiple languages, and interoperating

	with external systems
Social Media for Risk Communication and Community Engagement (RCCE)	Utilization of social media for health messaging dissemination
Social Monitoring	Capture of what is said in social media platforms
Telemedicine	Platform used by providers to connect with patients and share video and images. It can be integrated with a provider's electronic health record and scheduling systems
Track and Trace System	Track and Trace systems enable the traceability/visibility of products from origin through various distribution processes down to patient
Traditional Media	Traditional media that may be used for outreach and messaging (TV, radio, other)

Additional Resources

Resources	Description	Website
Mapping of Digital Health Tools and Technologies in Countries (View only)	This workbook indicates the presence of tools and digital technologies being used for health initiatives and other sectors in UNICEF Country Offices (COs)	http://uni.cf/mapping-digital-health
M&M Global goods possible use cases	This document provides a list of Digital Square approved global goods mapped across the use cases visualized in the DATEC. The global goods are grouped by those that have already been adapted to match a use case and those that could be adapted to match a use case (i.e., simple, easy, low-lift adaptations).	https://static1.squarespace.com/static/59bc3457ccc5c5890fe7cacd/t/60522885399dca3568666606/1615997063979/Global+Goods+COVID+Map.pdf
Digital Implementation Investment Guide (DIIG): Integrating Digital Interventions into Health Programmes	This practical Guide provides a systematic process for countries to develop a costed implementation plan for digital health within one or more health programme areas, drawing guidance from the WHO guideline-recommended digital health interventions, providing direction to ensure investments are needs-based and contribute effective and interoperable systems aligned with national digital architecture, country readiness, health system and policy goals.	https://www.who.int/publications/item/9789240010567
Digital Health Atlas	The Digital Health Atlas is a WHO global technology registry platform aiming to strengthen the value and impact of digital health investments, improve coordination, and facilitate institutionalization and scale.	https://digitalhealthatlas.org/en/
Global Digital Health Index Country Profile	The Global Digital Health Index is an interactive digital resource that tracks, monitors, and evaluates the use of digital technology for health across countries.	http://index.digitalhealthindex.org/map

Assessing country readiness for COVID-19 vaccines	The country readiness assessments for COVID-19 vaccines are undertaken jointly by governments; the World Bank; Gavi, the Global Vaccine Alliance; the Global Fund to Fight AIDS, Malaria and Tuberculosis; UNICEF and the World Health Organization. This report presents initial findings of 128 countries as of March 2021	https://documents1.worldbank.org/curated/en/467291615997445437/pdf/Assessing-Country-Readiness-for-COVID-19-Vaccines-First-Insights-from-the-Assessment-Rollout.pdf
---	--	---