Comprehensive assessment of Oman's health information system 2019

World Health Organization

REGIONAL OFFICE FOR THE Eastern Mediterranean

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Foreword

A well-functioning national health information system (HIS) is a prerequisite for the provision of reliable and timely health-related information. This information is necessary to make available key health indicators essential for policy development and evidence-informed decision-making; proper health management and rational resource allocation; monitoring and evaluation of health systems development; and monitoring the progress towards achieving the targets of the health-related Sustainable Development Goals.

Oman has invested significant resources in developing a strong National Health Statistics and Information System within the Ministry of Health. In addition, a research centre in the Ministry of Health complements existing efforts by providing relevant health information from national health research and surveys. These two bodies provide the necessary data for ensuring that reliable, relevant, up-to-date and timely health and health-related information is available and accessible for health managers at different levels of the health system. They have both contributed to the development, proper implementation, monitoring and evaluation of the five-year health development plans.

Developments in the NHSIS have been driven by the political will to support applying evidence-based decision-making and by the belief that health developments can be planned and monitored with quality and timely data and information.

There is a need to sustain and further develop the NHSIS and research centre to sustain and strengthen their capabilities in generating, compiling and analysing health and health-related data and producing relevant health indicators and policy briefs. Efforts should continue to further strengthen evidence-based policy and decision-making.

The aim of this comprehensive HIS assessment is to review the national situation, identify constraints and collectively develop and implement strategic directions to address these and to support the country in reinforcing informed decision-making and strengthening our capacity to monitor national health development.

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Preface

The role of HISs, including civil registration and vital statistics (CRVS) systems, in generating health information data for programme and performance monitoring, quality of care, planning and policy making is widely acknowledged. To effectively monitor progress towards the health-related Sustainable Development Goals (SDGs), countries are encouraged to generate reliable data to track progress and inform decision-making. Consistent with its General Programme of Work 2019–2023, the World Health Organization (WHO) is collaborating with Member States to improve their HIS, analytical capacity and reporting for universal health coverage. In particular, WHO is supporting countries to develop comprehensive and efficient systems to monitor health risks and determinants; track health status and outcomes, including cause-specific mortality; and assess health system performance. The Organization is also helping countries to disaggregate data so that progress made on gender equality and health equity can be measured.

Since 2012, WHO has been working with Member States to agree on priority actions to strengthen HISs. Through a consultative process and intensive work with Member States, WHO has developed a framework for the HIS and 75 core health indicators that focus on three main components: monitoring health determinants and risks; assessing health status, including morbidity and cause-specific mortality; and assessing health system response.

As part of WHO efforts to support Member States in meeting their national, regional and international obligations in reporting health indicators, a number of comprehensive HIS assessments have been conducted in the Eastern Mediterranean Region since 2016 to identify key gaps and strategies to strengthen HISs. The first comprehensive assessment was conducted in Jordan, followed by Libya, Pakistan, Afghanistan, Iraq, Lebanon, and Oman. The assessment identified gaps in HISs and generated recommendations and priority actions aimed at improving country health data systems.

We hope this report will guide decision-makers in the Ministry of Health and all development partners and stakeholders in planning and implementing effective interventions to enhance the Oman national HIS. WHO expects that the priority areas identified by the assessment team and ongoing strategies to improve the CRVS, including the quality of cause of death data, will enhance Oman's efforts to monitor the health situation and the health-related SDGs in particular.

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Acronyms

CRVS   Civil registration and vital statistics

HIS   Health information system

HL7   Health Level 7 (a set of international standards for health informatics)

ICD   International Classification of Diseases

ICD-10-CM   International Classification of Diseases (version 10) Clinical Modification

SDGs   Sustainable Development Goals

SQL   Structured query language

WHO   World Health Organization

Executive summary

Overview

Health information systems (HIS), including civil registration and vital statistics (CRVS) systems, remain key sources of data for evidence-based decision-making both at the national and subnational level. Oman, with the support of the World Health Organization (WHO) and other international organizations, has demonstrated key improvements in the collection of key health information and its use in decision-making. The implementation of the Al-Shifa system, a comprehensive electronic health management information system, is one of the key achievements of the country. The country is also able to report several key indicators annually. Nevertheless, with increased technological advancement and increased global demands to generate reliable data to monitor progress towards universal health coverage and the WHO General Programme of Work (2019–2023) Impact Framework, in collaboration with the Ministry of Health, WHO conducted an assessment of the national HIS from 25 to 29 August 2019. The assessment approach involved holding meetings with relevant staff from the Ministry of Health and other stakeholders; conducting field visits to various levels of health facilities, both public and private; and conducting a national workshop in Muscat. The assessment team reviewed the operations of the HIS in terms of its adherence to sound policy and institutional environment; utilization of well-functioning data sources; availability of strong institutional capacity for data collection, management, analysis, use and dissemination; and implementation of effective mechanisms for review, data use and action. Using a methodology developed by the WHO Regional Office for the Eastern Mediterranean for conducting HIS assessments, the assessment team was guided by the WHO Monitoring and Evaluation Assessment and Planning tool, which provides an overview of the weaknesses and strengths of the country monitoring and evaluation systems and enables identification of priority actions based on those findings.

Findings

Key observations were made relating to HIS operations in Oman. Some of the main strengths of the HIS include the commitment of the government to modernize the public health sector, investment in the hospital management information system (Al-Shifa system), and the alignment of all key programmes and operations with Health Vision 2050. The CRVS system assessment that was conducted in 2013 generated momentum to improve the quality of cause of death data. The country is also acting as a Centre of Excellence in the Region, with growing interest among other Member States to adopt the Al-Shifa system.

While acknowledging the significant investments made by the Ministry of Health and other stakeholders to enhance the HIS in Oman, the assessment team found that about 9% of the attributes of a functional HIS across all components require extensive strengthening. A further 49% require some strengthening. Thus, 42% of the attributes are already present in the national HIS, with further opportunities for improvement. The very weak dimensions include key strategic areas such as a regular system for review of progress and performance against national and locally defined priorities; the active involvement and support of civil society actors; strong analytical institutional capacity for supporting the synthesis of data; and synthesis and analysis of all national data from all relevant sources using a collaborative approach involving the Ministry of Health, the Centre for Statistics and Information and technical experts, including the public and private sectors. Ensuring that enough staff are available at all levels to conduct public health surveillance and response and that routine recording systems are in place for tracking private and public health expenditures (e.g. private insurance) are key areas that also need much strengthening. The detailed priority actions and timeline are presented in the main body of the report. The main recommendations arising from the assessment are presented below.

Policy, governance and institutional environment

▶ Ensure that the same standards in integrating the new private health sector insurance scheme – use of a unique identifier (biometric, national identification number, or medical record number) for patients in private health facilities in order to support comparison and linkages of data sets at the national level – are applied when Al-Shifa is rolled out to private health facilities. Notable efforts are already being made to ensure the use of a unique health record across all relevant platforms and systems. For example, the Al-Shifa system has started capturing the civil ID for all elective services and linking hospital patient IDs with them, both within the hospitals and in the Ministry of Health central Master Patient Index, which has become the backbone of the National eHealth Repository Project. This approach enables the integration of all patient files using a single unique civil identifier from all Ministry of Health institutions.

▶ Modify the legal and policy framework for implementing an integrated national HIS to support the ongoing efforts and current achievements to develop an integrated national HIS. The framework should also cover establishing the legality of electronic documents, processes and related data transfers.

▶ Develop a unified mechanism to implement an electronic facility auditing system to regularly monitor progress and quality control. This can be achieved by ensuring that the national committees that recommend, adopt and prioritize change requests for quality assurance in Al-Shifa also have a greater scope to address wider auditing and monitoring needs in the quality assurance process.

▶ Develop mechanisms to make Al-Shifa a general reference architecture available as a global public good to benefit other countries which are implementing interventions to strengthen their hospital management information system. The requirements specifications, features and operations approach to build Al-Shifa could guide other countries appropriately. There are also advantages to making Al-Shifa a global public good. This includes broader participation in software development, not relying only on national resources to maintain the system. And making access to the system transparent would also raise the level of quality and trust as others could review and vet its features. In pursuing this, it is also important to ensure that Oman's intellectual property is protected.

▶ Scale-up implementation of e-notification systems and capacity-building of staff in e-notification in private facilities. Lessons learnt from the rolling out of communicable disease notification in the private sector may provide an opportunity for scaling up similar efforts.

Data sources

Health systems, health facility, and community information systems

▶ Build on current efforts and interventions to improve e-notification systems in general, and continue enhancing the functionality of the current e-notification system to enable calculation of indicators on coverage and control of noncommunicable diseases in line with universal health coverage reporting requirements.

▶ Develop a transition plan from the International Classification of Diseases version 10 (ICD-10) to ICD-11, including a plan to implement the International Classification of Health Interventions. The plans should be based on the results from the feasibility assessments for implementing ICD-11.

▶ Engage the private sector to implement Al-Shifa in private health facilities to enhance data sharing and interoperability. This should be a long-term goal contingent on the availability of resources.

- Implement WHO standards that have been modelled on the District Health Information System, version 2 (DHIS-2), as a reference platform to model information capture, representation and analysis (e.g. for malaria, tuberculosis, HIV/AIDS and cause of death). This would provide an opportunity for the country to be part of efforts in the Region in fostering business-to-business reporting of aggregate data sets to regional and international development partners such as WHO.

- Enhance the functionality of committees at the facility level that oversee and support data collection and utilization at the facility and the community levels. This can be done by developing/updating the terms of reference.

Disease surveillance

- Develop the capacity of staff in relevant areas of disease surveillance.

- Develop a national standardized framework for noncommunicable disease indicators.

- Increase staffing levels to perform expected public health surveillance and response activities.

Civil registration and vital statistics, household surveys and census

- Develop a harmonized national survey plan to generate relevant data and enhance the reporting of core health indicators. The focus should be on harmonized, stand-alone modules that can be implemented in any relevant survey.

- Improve the death registration system through advocacy at both the national and community levels in order to improve completeness of cause of death data. Addressing this should also take into consideration the significant proportion of expatriate and naturalized citizens.

- Implement cause of death coding into the curriculum in medical schools.

Institutional capacity for data management and analysis

- Along with relevant stakeholders, develop a comprehensive timeline and identify the resources required to implement extensive real-time integration and interoperability of tools and systems between actors such as private sector insurance providers, private health care facilities and providers, the Ministry of Health and associated health data sets, the Royal Oman Police, the Capital Market Authority with the Central Birth and Death Registry system. The planned integration should focus on data exchange formats; data governance, policy and laws; portals and application programming interfaces for the private sector interaction with national government systems; and utilization of government norms and standards within private sector systems implementation.

- Scale up data storage and management systems, including the Big Data analytical tools in line with the growth of information storage and retrieval needs. This should be done as part of existing efforts and plans by the Directorate General of Information Technology to adopt the Big Data NoSQL (Structured Query Language) analytical tools.

- Continue developing and launching relevant modules in the Al-Shifa system for data analytics, machine learning and artificial intelligence (AI) libraries by building on the efforts made by the Ministry of Health in launching an AI-based system for mammogram analysis for breast cancer and the system planned for cardiovascular diseases.

- Improve relevant capacity, including the development of a career pathway for health information officers and HIS operators at different levels.

- Build the capacity of staff in data management, analysis and use, with a focus on health system quality indicators.

► Develop standard operating procedures for guiding data and information exchange to facilitate inter- and intrasectoral exchange of patient information utilizing systems other than Al-Shifa. This should involve wider stakeholder (Ministry of Health and other actors) consultation and participation to identify the content of data exchange needs and the processes driving them.

Mechanisms for data use, review and action

► Consistent with the Seventy-first World Health Assembly digital health resolution (A71/A/CONF./1), build an investment case by conducting case studies of Al-Shifa on how to perform data analysis and national reporting on a comprehensive real-time national data set. This would also benefit other countries in building digital health tools for identifying digital health strategies and projects that offer affordable value for money and mitigate risk.[1]

► Develop customized dashboards to extract information regularly from Al-Shifa to assess service readiness and availability.

► Develop mechanisms for independent review of data and indicators for selected programmes to ensure standardization and consistency with national strategies, targets and indicators related to universal health coverage.

► Update frameworks for monitoring and evaluation indicators that focus on quality, output, outcome and impact at different levels.

► Improve capacity of staff through training to develop policy briefs to enhance the use of information for decision-making.

► Develop research and analytical plans to showcase how large (Al-Shifa) data sets can be used in the context of data use for decision-making. This can be achieved by conducting coordinated reviews of the current databases in Al-Shifa to identify their research and analytical potential.

► Publish and enhance the functionality of the national health observatory using the wealth of existing data at the national level. This could offer stakeholders an opportunity to review a comprehensive nationwide set of dashboards on the status of the health system and the population.

Enhancing information technology functionality

► The deployment of a reliable and high-quality private government cloud (G-Cloud) should be considered once all the resource and infrastructure challenges related to network infrastructure in selected parts of the country are addressed.

► While acknowledging current efforts by the Directorate General of Information Technology to maintain national and international standards as building blocks of the information system, e.g. implementation of the Health Level 7 Fast Healthcare Interoperability Resources (HL7-FHIR), it is evident that the current HIS is somewhat fragmented between different health programmes and the Ministry of Health, the military health system and the National Centre for Statistics and Information. A new integration/migration plan is needed; this should build on lessons learnt from the successful implementation of the national e-health repository.

► The core Al-Shifa uses mainly the Oracle suite of products and some open source software for its various modules. Al-Shifa should consider migrating from Oracle and its native functions into a suitable open source database (supporting both SQL/NoSQL modes or plan for the new technology of development tools such as low code software). Considering that the Ministry

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[1] The draft digital health resolution is available at http://apps.who.int/gb/ebwha/pdf_files/WHA71/A71_ACONF1-en.pdf, accessed 27 October 2020.

of Health has a large investment in the Oracle suite technology, any change to open source technology would likely be quite disruptive and would need to be carefully planned. Due to the complexity and immensity of the Al-Shifa system, the transition to open source will require careful consideration and addressing challenges related to human resources and networking infrastructure for running centralized systems.

▶ For proper data governance, and once all the network infrastructure challenges and limited bandwidth in all remaining areas have been resolved, the whole Al-Shifa system must be integrated by an enterprise service bus along with an application programming interface management system. Among other things, current efforts by the Directorate General of Information Technology, such as the implementation of an open source enterprise service bus for non-critical data sharing, the open source Apache Camel platform for national e-health record systems, and the open source platform WSO2 for a laboratory referral system, demonstrate the government's commitment towards the implementation of integrated systems for enhanced efficiency and cost–effectiveness.

▶ Augment the current fixed password login method in Al-Shifa with more advanced authentication methods. This should be done to the extent possible once all the technical issues, such as those related to Ministry of Health intranet clients and other platforms, are resolved.

▶ Develop a fully automated and linked system across all facilities and data collection platforms to minimize duplications arising from paper-based registries and facilitate automatic report generation for decision-making. Current efforts to develop electronic registries are acknowledged and will make implementation of this recommendation a reality.

Way forward

There are existing opportunities to enhance the operations of the HIS in Oman. Across all the functional areas, 55 actions were identified during the assessment to enhance its operations. The detailed priority actions will provide an opportunity for the Ministry of Health, in collaboration with WHO and other HIS stakeholders and development partners, to deploy interventions to enhance the HIS in the short, medium and long term. Some of the interventions can be implemented with limited effort, without a great deal of change to the existing systems, and with the leadership of the Ministry of Health. However, to ensure effective monitoring of the progress in implementing interventions, a functional national HIS coordinating mechanism should be enhanced to oversee this process. The agreed set of recommendations/priority actions can be costed to facilitate domestic and external resource mobilization. The timelines for implementation of the interventions can be adjusted depending on the local circumstances.

1. Introduction

1.1 Demographics

Oman is administratively divided into 11 governorates: Muscat, Dhofar, Musandam, Buraimi, Ad Dakhliyah, Al Batinah North, Al Batinah South, Ash Sharqiyah North, Ash Sharqiyah South, Adh Dhahirah and Al Wusta. These governorates are further subdivided into 61 *wilayats* (states).

The total estimated mid-year population was about 4.6 million in 2018, with a sex ratio of about 102 males per 100 females for the Omani population (183:100 for the total population) based on a 2018 population estimate. The age structure is young: about 15% of the population is under 5 years and 37% under 15 years; only 5.9% are aged 60 years and over. About a quarter (24%) of the total Omani population comprises females in the reproductive age group (15–49 years). Women in this age group represent nearly 48.4% of all females. The total fertility rate in Oman in 2018 was 3.9 children per woman, and the crude birth rate was estimated at 32.2 births per 1000 Omani population. This represents a drop of 20.3% over the past 25 years from a crude birth rate of 40.3 births per 1000 in 1993. This has also been accompanied by a decline in the crude death rate from 7.3 deaths per 1000 population in 1993 to 2.7 deaths per 1000 population in 2018.

1.2 Overview of the health situation in Oman

The Ministry of Health is the main health care provider and is responsible for ensuring the availability of health policies and plans and monitoring their implementation. Other health care providers include the Armed Forces Medical Services (three hospitals), the Royal Oman Police Medical Services (two hospitals), Sultan Qaboos University Hospital, the medical services of Diwan of Royal Court, the Petroleum Development Oman medical services and the private sector.

Oman has made tremendous achievements in ensuring good health for all since the 1970s. These achievements have been highlighted in various national and international fora and by various national and international organizations. For example, the United Nations Children's Fund (UNICEF) reported in 1993 that Oman was the first country in the Middle East and North Africa Region, and the second globally, to reduce the under-5 mortality rate by two thirds between 1981 and 1991.[2] Since then the country has continued to improve the health situation of its people and the successes have been documented in various reports such as the World Health Report 2000, in which WHO ranked the health system in Oman first among the 191 Members States in efficiency to improve health and eighth with respect to the overall efficiency of the health system.[3] The Health Development Report 2010 also reported that Oman had made the fastest progress in the Human Development Index, which was attributed to achievements in health and education.[4]

Like most countries of the world, Oman has witnessed both a demographic and an epidemiological transition. With a life expectancy at birth of 77.0 years (75.0 years for males, 79.1 years for females)[5], the population is ageing and the disease profile is dominated by noncommunicable diseases and injuries. This transition, coupled with worldwide advances in technology, has led to improvements in health system delivery, but also imposes a huge burden on the health system. Oman's Basic Statute of the State (issued in 1996

[2]   The progress of nations. New York: UNICEF; 1997 (https://www.unicef.org/french/about/history/files/pub_pon97_en.pdf, accessed 31 October 2020).

[3]   The world health report 2000. Health systems: improving performance. Geneva: World Health Organization; 2000 (https://www.who.int/whr/2000/en/whr00_en.pdf?ua=1, accessed 31 October 2020).

[4]   Human development report 2010. The real wealth of nations: pathways to human development. New York: United Nations Development Programme; 2010 (http://hdr.undp.org/sites/default/files/reports/270/hdr_2010_en_complete_reprint.pdf, accessed 31 October 2020).

[5]   World health statistics 2019: monitoring health for the SDGs. Geneva: World Health Organization 2019 (https://www.who.int/gho/publications/world_health_statistics/2019/en/, accessed 31 October 2020).

by Decree 101/96) highlights the role of the state in, among other things, providing health care for every citizen, and encourages the establishment of private hospitals, polyclinics and medical institutions. The Government is also committed to providing health services and care free of charge, with the health care system considered a national public health care model.[6]

The significant investments in health made in the country have led to improvements in health outcomes as reflected in other recent key health indicators such as the universal health coverage service coverage index at 75.2% (2017);[7] 14.8 hospital beds per 10 000 population (2018); 76.3% of women attending antenatal care (4+ visits, 2018); universal measles immunization coverage in 2018 and achieving the elimination target (2019); a maternal mortality rate of 15.1 deaths per 100 000 live births (2018); a neonatal mortality rate of 5.5 deaths per 1000 live births (2018); and almost universal access to improved water (95%) and sanitation (99%) facilities (2016).[8]

Oman is also making tremendous progress in incorporating Sustainable Development Goal (SDG) 3 targets in health policy, strategy and planning. The Health Vision 2050 plan, developed in 2012 and published in 2014, not only describes the current health system in Oman but also provides a long-term vision for health development for Oman. The Vision is managed via 5-year plans. The ninth 5-year plan (2016–2020) is the latest national health policy and strategy, and is consistent with the SDGs and universal health coverage.[9]

2. Purpose and objectives of assessment

The role of HISs, including CRVS systems, in generating health information data for programme and performance monitoring, quality of care, planning and policy-making is widely acknowledged. Within the context of the Agenda for Sustainable Development, countries are encouraged to generate reliable data to track progress and inform decision-making. In line with the its General Programme of Work 2019–2023, WHO is collaborating with Member States to improve their HISs, analytical capacity and reporting for universal health coverage. In particular, the Organization is supporting countries to develop comprehensive and efficient systems to monitor health risks and determinants; track health status and outcomes, including cause-specific mortality; and assess health system performance. The Organization is also helping countries to disaggregate data so that progress made on gender equality and health equity can be measured.[10]

A comprehensive assessment was needed to support the country's efforts to monitor its health development agenda, as well as enhance its reporting capacity on the 100 core health indicators (plus health-related SDGs) and the 75 regional core health indicators. A comprehensive approach enabled the identification of weaknesses and strengths in the monitoring and evaluation system and the HIS, and to identify priority actions based on those findings.

Following consultations with the Ministry of Health, the key objectives of the assessment as outlined in the terms of reference were to:

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[6] Health Vision 2050. Muscat: Ministry of Health; 2014 (https://www.moh.gov.om/documents/16506/119833/ Health+Vision+2050/7b6f40f3-8f93-4397-9fde-34e04026b829, accessed 14 October 2019).

[7] Annual health report 2018. Muscat: Ministry of Health; 2018 (https://www.moh.gov.om/en/web/statistics/annual-reports, accessed 28 August 2020).

[8] Framework for health information systems and core indicators for monitoring health situation and health system performance 2018. Cairo: World Health Organization Regional Office for the Eastern Mediterranean; 2019.

[9] Health and SDGs brief 2019: Oman. Cairo: WHO Regional Office for the Eastern Mediterranean; 2019.

[10] Thirteenth General Programme of Work 2019–2023. Geneva: World Health Organization; 2019 (https://apps.who.int/iris/bitstream/ handle/10665/324775/WHO-PRP-18.1-eng.pdf, accessed 31 October 2020).
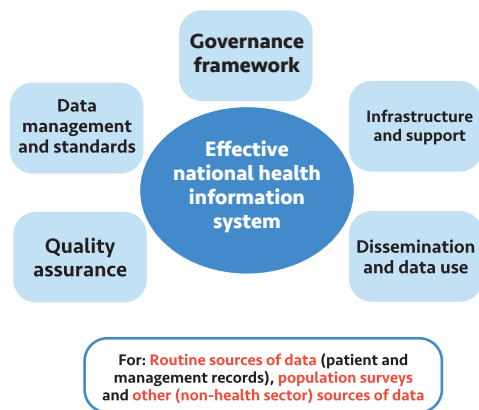
Fig. 1. Adapted model of an effective national health information system

to monitor progress towards the SDGs and universal health coverage;

▶ recommend strategies that can scale up the system to make it more user friendly and accessible by all health actors;

▶ develop a roadmap to strengthen the HIS on the findings of the assessment, including priority actions, responsible parties or stakeholders and timeline.

The results of the assessment will support the Ministry of Health to develop a prioritized and detailed roadmap to improve the HIS and the reporting of core indicators at the national, regional and international levels.

3. Assessment methodology

The methodology was based on an approach developed by the WHO Regional Office for the Eastern Mediterranean for comprehensive assessment of an HIS (Fig.1). The approach involved assessment of a checklist of the attributes of the five main components of the monitoring and evaluation system: governance; infrastructure; data management and standards; quality assurance; and dissemination and use of data.

Discussions during the assessment were guided by the WHO Monitoring and Evaluation Assessment and Planning tool,[11] which provides an overview of the weaknesses and strengths of a country's monitoring and evaluation systems and enables identification of priority actions based on those findings.

As part of the mission preparations, the team reviewed documents provided by the Ministry of Health, documents on interventions by other development partners to improve the HIS, and documents available in the public domain (Annex 1).

▶ understand health-related information systems and databases available in Oman in order to identify areas for improvement, particularly on information flow across the country;

▶ provide documentation on the different sources of data for the HIS, i.e. population-based, institution-based, service and individual records, and surveillance or community system;

▶ provide an understanding of their content, data elements or level of disaggregation, and associated reporting burden and how these information systems are used and by whom;

▶ assess the strengths and weaknesses of these components and operations within the HIS, including aspects of governance, infrastructure, data management and standards, quality assurance, and data dissemination and use;

▶ provide recommendations for HIS strengthening consistent with international standards, indicator frameworks and guidelines;

▶ recommend strategies that build the capacity of the information management system enabling it to produce core indicators on disease burden, health access and utilization, and mortality and human resources, including generating data

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[11] O'Neill K, Viswanathan K, Celades E, Boerma T. Monitoring, evaluation and review of national health policies, strategies and plans. In: Schmets G, Rajan D, Kadandale S, eds. Strategizing national health in the 21st century: a handbook, ch. 9. Geneva: World Health Organization; 2016.

Field visits were conducted by two teams during 25–27 August 2019 to the following institutions and facilities:

► Dhofar Governorate: Al-Dhariz Health Centre; Sultan Qaboos Hospital; Central Medical Store; Oman College of Health Sciences; Badr Al Samaa Private Hospital;

► Muscat Governorate: National Centre for Statistics and Information; Oman Medical Speciality Board; Capital Market Authority; Khawlah Hospital; Directorate General of Civil Status; Al Khuwayr North Health Centre;

► South Al Batinah Governorate: Regional Health Information Office; Al Rustaq Health Centre.

The assessment team also met with heads of departments, managers of facilities, service providers, and HIS officers in the three governorates. Meetings were also conducted with staff from the Department of Health Information and Statistics and the Research Centre in the Directorate General of Planning and Studies. Notes on discussions and findings were assimilated and analysed. A two-day workshop was conducted in Muscat during 28–29 August 2019 to disseminate the assessment results, build consensus on the findings and identify priority actions.

In addition to the document reviews and the information gathered during the meetings and field visits, the team also made technical judgements and consolidated the findings according to the thematic areas of the Monitoring and Evaluation Assessment and Planning tool. The team used this information to formulate recommendations for HIS improvement in Oman. The assessment findings were shared with the Ministry of Health and all stakeholders.

4. Key findings

4.1   Approach

Improved collection, processing, analysis, dissemination and use of health information is a key step in achieving better health outcomes in Oman. Evidence-based decision-making can be realized if a country has a functional, integrated and comprehensive HIS. In Oman, as is the case elsewhere, the HIS provides data for multiple users and a wide range of purposes. The assessment team used the HIS assessment and planning tool to obtain an overview of the current status of the various components of a functional HIS and to identify priority actions that required further strengthening or development. The assessment tool comprises a checklist of 71 attributes of the four main components of a functioning HIS platform: sound policy and institutional environment; well-functioning data sources; strong analytical capacities; and mechanisms for review and action. The key findings focus on two key components: observations from field visits in selected facilities and institutions, and a quantitative assessment on the availability of key attributes of a functional HIS. This is followed by a discussion on the key priorities to enhance the HIS in Oman.

4.2   The health information system in Oman

4.2.1   Overview

The HIS is designed to ensure that reliable, relevant, up-to-date and timely health and health-related information is available and accessible to health managers at every level of the health care system for use in decision-making, planning and evaluation. Health information is also used to monitor the implementation of health plans, measure the health status of the population and recognize changing trends in the burden of disease. This information is also used to identify health and health-related problems and health care needs, and to prioritize these for planning purposes. Evaluation of the effectiveness of health system performance and health status is conducted using the products from the national HIS.

The health system in Oman benefits from a well developed national health statistics and information system, which is reflected in Health Vision 2050. Oman's rapid move towards an IT-based HIS management system is well acknowledged in the Region. Data for the system

come from two main categories: population-based sources (censuses, vital registration, household surveys) and institution-based sources (facility surveys, facility records, individual records). Routine HIS data are collected at regular intervals in public and private health facilities and institutions at community-level. The data provide an opportunity to study dynamics in health status, health services and health resources. Forms completed by health institutions at the beginning of each month capture data generated during the previous month. These are reviewed by a *wilayat*-based statistician and then forwarded electronically to a regional statistician, who reviews and compiles the data at the regional level. The compiled data are sent to the Department of Information and Statistics at the Ministry of Health headquarters, which compiles the data at the national level and subjects it to comprehensive analysis and information generation for planning and monitoring and evaluation.

Recently, the Ministry of Health has also developed a central data warehouse, Nabdh Al-Shifa, to collect the historical data generated by the HIS. Where sufficient network bandwidth is available, real-time data capture is enabled, and for the rest of the institutions the data are extracted and loaded into the warehouse at the end of every month. These data are used for many of the current data analysis requirements.

Health surveys constitute one of the key sources of information in Oman. Large population-based surveys are conducted regularly to provide multiple indicators based on country needs and priorities. Other health-related surveys are conducted by other sectors in collaboration with the Ministry of Health. These surveys generally collect data to generate information on determinants of health which are difficult to obtain from health records using the routine HIS. Notable surveys conducted during the recent past include the Global Youth Tobacco Survey, the Global school-based student health survey, the National Health Survey, Oman World Health Survey, the National Health Noncommunicable Diseases and the Risk Factors

Survey, and Oman Nutrition Survey. However, there is no standardized national survey plan.

The first fully electronic e-census 2020 is the fourth census in Oman. The regulatory framework for this was initiated by Royal Decree 15/2015. The e-census 2020 involves four committees, with the main committee, the Supreme National Committee, chaired by the Minister of Heritage and Culture. Contrary to previous censuses, Oman is working to build a new database based on a national administrative vision, and this will contain almost all the information related to any person in Oman, from birth to death. Demographic, housing and establishments' information are the main blocks of the e-census 2020. The main aim of this project is to integrate electronically all related databases from different ministries, organizations and companies and combine them into one national database. The Ministry of Health has already identified the key data elements to be integrated into this database, and the technical work to achieve the real time integration was being carried out at the time of finalizing this report.

The civil registration system has been part of the Royal Oman Police since 2004; it uses a national identification system and is integrated with Al-Shifa system (see detailed discussion in Section 1.2.2)[12] for births, deaths and cause of death registration (known as the Ajyal system).

4.2.2 Routine health information system data sources

Data for the HIS are collected from Ministry of Health facilities using a variety of platforms such as the Al-Shifa system and the Health and Diseases Records. In addition, two programmes extracted from Al-Shifa are used, the Central Birth and Death Registration and Nabdh Al-Shifa (dashboard).

The following is a brief description of the major routine data collection systems.

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[12] An integrated health care management information system.

- **Health and diseases records and registers** include in- and outpatient records in health care facilities. In addition, there are other records such as disease surveillance for communicable diseases, disease registers (e.g. cancer, tuberculosis (TB), congenital anomalies, diabetes, hypertension, Integrated Management of Childhood Illness and asthma). The Ministry of Health maintains electronic records of notifications through an e-notification system called Tarassud. Cancer registers include information for all cases of cancer diagnosed or managed in the country based on histological diagnosis. Nationals diagnosed in nearby hospitals and in neighbouring countries are also registered through proper coordination with such hospitals. The TB register includes information for all patients diagnosed within the country. Treatment of TB is only available in public health care facilities, ensuring the registration of all cases. The register includes data on follow-up and outcome of treatment. All congenital anomalies detected in children born since 2000 are also registered.

- **Health facility records** are sources for morbidity and mortality data in addition to service utilization. Surveillance for communicable diseases covers 19 diseases and two conditions that require immediate notification within 24 hours, and 17 diseases that require notifications within a week. Efforts are also made to ensure that health records from private facilities include cases diagnosed or detected by all health care providers. However, this requires proper validation. The pharmacy unit in each facility also uses Al-Shifa to track available medicines at the facility and the doses received by each patient. The e-notification system, Tarassud, is also key in collecting various information such as disease surveillance records and registers.

- **Capacity and practice:** hospital and health centre records in the Ministry of Health are computerized in more than 90% of public sector facilities. This e-portal enables the registration of services with pharmacy, supply chain and other administrative registers. The new version

of the e-notification system, Tarassud, was under development during the time of the assessment. Health registers are supervised by departments other than the NHSIS.

- The NHSIS is supervised by the Department of Information and Statistics at the Directorate General of Planning and Studies. It captures the routine data such as manpower, health services utilization and distribution of health institutions, among others. Health registers are supervised by different departments in the Ministry of Health such as maternal and child health, noncommunicable diseases, and primary health care supportive services and nutrition. These departments provide several monthly statistics which have been established from health registers. For example, the maternal and child health department collects antenatal and postnatal health care from the ANC register.

- **Al-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. At the time of the HIS assessment, the system was installed in more than 220 health care facilities of varying sizes and capabilities, including several non-Ministry of Health caregiver facilities. The system was developed in 1999 and has evolved over the years; the current version (3+) is being updated to a new version, expected to be released by the end of 2020. The new structure will be useful in redeveloping Al-Shifa system modules using new web technology. It will also be an open source, Java-based system. Al-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. The system is gradually expanding to include the corporate and private sectors. Al-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 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.

▶ **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.

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.

▶ **Nabdh 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.

▶ **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.

- ▶ **e-Notification system (Tarassud):** 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.

- ▶ **National eHealth Registry:** 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.

- ▶ **National Blood and Donation Registry:** The system 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.

- ▶ **Centres of Disease Control Information System:** This 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.

- ▶ **Incident reporting system:** This 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.

Some facilities are still using paper-based systems, especially those in remote areas on the southern border with Yemen. A number of manual reports and disease registers have not yet been completely migrated to the electronic system. The Directorate General of Planning and Studies has emphasized that digital transformation is key to improving patient flow efficiency and easing the referral process. To ensure a streamlined transformation, the Ministry of Health is working proactively towards digitizing paper-based processes while integrating paper-based sources with electronic patient records. Oman is also planning to migrate completely to an electronic HIS (including electronic medical records and aggregate health information data) by 2020. Data from health records and registers are disseminated through annual health reports from the Ministry of Health. The cancer reports are published annually presenting statistics from cancer registers. These data are also integrated within the NHSIS and regularly updated to monitor activities.

4.3   Observations from field visits

A summary of the key findings from each of the teams has been consolidated in accordance with the four functional areas of a functional HIS (Table 1).

Table 1. Key observations on the health information system functionality from field visits

1. Sound policy and institutional environment

Strengths

- Health Vision 2050 and a 5-year plan are in place, including an aggressive plan to reach its goals in provision of quality of health services.

- National health plan with indicators which also reflects considerable progress and improvements on health indicators during the past few decades.

- "Centre of Excellence" with delegations from other countries in the Region visiting to study the Al-Shifa system.

- Commitment of government to enhance functionality of the HIS through investment in the locally designed and developed HIS, Al-Shifa 3+. The Al-Shifa system is being continuously updated to include more features based on user feedback. Version 4 is planned for release soon.

- Implementation of data exchange standards, e.g. based on HL7 International and FHIR.

- The National Statistical and Planning Centre supports higher level decision-making.

- Authorities support the growth of the private sector to ensure quality services are being provided to the public.

- Oman has made a significant investment and great progress in the implementation of a nationwide National ID system and associated CRVS implementation. Given the open-architecture design of the system and its place in the overall Government-to-Government Omani environment, this system will form a key underlying data service for many subsequent digital development efforts within the country, both in the health sector and elsewhere.

- Statistics Royal Decree mandates the use of the civil ID as an identifier.

- There is collaboration between national HIS stakeholders to improve the quality of HIS data through the National Health Information Management Committee.

- Private health facilities submit data to the Ministry of Health.

- Specialized bachelor's degree in health information management in the College of Health Sciences provides practical virtual training on the Al-Shifa system.

- Bachelor's degree in statistics with a minor in health statistics, a collaboration between the Ministry of Health and Sultan Qaboos University, Faculty of Science, Department of Statistics, is available. The curriculum was developed in collaboration with the Ministry of Health.

- Planned shift from ICD-10 to ICD-11.

1. Sound policy and institutional environment

Potential areas for improvement

- The legal and policy framework for implementing an integrated national HIS needs to be modified in line with the goals of the Oman 2050 Health Vision.

- Al-Shifa system can run as a centralized system with a unique ID for all patients across institutions once a reliable, widely available, sufficiently fast network infrastructure is in place, including addressing any human resources needs.

- The Al-Shifa system should use a unique ID for patients or build on existing efforts to use a unique health record across all relevant platforms and systems.

- The private sector would benefit from further integration into Al-Shifa, especially with the incoming private insurance scheme, and should also be encouraged to use a unique ID.

- The core Al-Shifa is built around the Oracle suite of products and other open source software for its various modules. There is a need to address the human resources needs and infrastructure challenges to ensure effective transition to an open source database which supports both SQL/NoSQL modes.

- For proper data governance, and once all the network infrastructure challenges and limited bandwidth in all remaining areas have been resolved, the entire Al-Shifa system must be integrated via an enterprise service bus along with an application programming interface management system. Among other things, current efforts by the Directorate General of Information Technology (such as implementation of an open source enterprise service bus for non-critical data sharing, the open source Apache Camel platform for NEHR systems and the open source WSO2 platform for the laboratory referral system) demonstrate the commitment of the government towards the implementation of integrated systems for enhanced efficiency and cost–effectiveness.

- The next version of Al-Shifa must fully abide by the security and privacy standards of the International Organization for Standardization such as ISO/ICE 2700.

- Developing/updating the national strategy for health information management within the national health strategy, including privacy and security of data, is needed.

2. Data sources

Strengths

- The computerized Al-Shifa system supports various core processes of the health care management system (e.g. management of patient and medicine records).

- All the patient and health records (automatic or manual) are stored and managed electronically in Al-Shifa.

- Data collection forms are comprehensive and are updated periodically in line with data and indicator needs at the national, regional and international levels.

- Data are available to support efficient planning (estimating demand, allocating resources and monitoring and evaluation process). This also includes a wealth of data about patients for further use such as the patient's health history data, physician's comments and prescriptions. This is an opportunity to perform analysis, reporting, long- and short-term analytics, alerting and other type of analyses.

- The core HIS system provides a simple to use graphic user interface with comprehensive health information that could be used by physicians for more effective treatment or improved quality of care (i.e. reduction in medical errors).

- The system provides easy access to the health and medication history of all patients at the point of care.

- The ICD-10 Standard and ICD-10 CM are extensively used (e.g. within Al-Shifa) for classifying and coding all diagnoses, symptoms and procedures recorded in conjunction with hospital care.

- SMS alerts for appointment reminders are used to ensure completeness of relevant data that require tracking of individuals.

- The shift from manual to electronic registers is proceeding (e.g. Oman Diabetes and Hypertension Register).

- A private health insurance information system is being embraced, with a clear consideration towards integration with the rest of the national HIS system via the Capital Market Authority.

2. Data sources

Potential areas for improvement

- The deployment of a reliable, high-quality private government cloud (G-Cloud) should be considered once all the resource and infrastructure challenges related to network infrastructure in selected parts of the country are addressed.

- The next generation of Al-Shifa should consider operating on the secure G-Cloud with Multiprotocol Label Switching, or being locally installed in all health facilities. The environment is also mature enough to consider deploying some modules of the system by using distributed technologies such as blockchains offering immutability across multiple actors (some private, some government).

- Augmentation of the current fixed password log-in method in Al-Shifa with more advanced authentication methods is proposed. This should be done to the extent possible once all the technical issues such as those related to Ministry of Health intranet clients and other platforms are resolved.

- Acknowledging current efforts by the Directorate General of Information Technology to maintain national and international standards as building blocks of the information system (e.g. implementation of HL7-FHIR), the current HIS system is somewhat fragmented between different health programmes and the Ministry of Health, the military health system and the National Centre for Statistics and Information. A new integration/migration plan is needed which should build on lessons learnt from the successful implementation of the National eHealth Repository.

- A fully automated, linked system across all facilities and data collection platforms needs to be developed to minimize data discrepancies. Current efforts to develop electronic registries are acknowledged and will facilitate the implementation of this initiative.

- The system alert system lacks the proper functionality to trigger critical actions such as properly alarming physicians on, for example, drug interactions, appropriate dose or possible stock out of medications. The review team understood that this gap is related to limited financial resources for licences which support these initiatives. However, this can be revisited in the future if new and affordable technology becomes available to support these functions.

- Address staffing shortages of coders to improve quality of cause of death data.

- Different coding for medicines between Ministry of Health facilities and private health facilities.

- Detailed analysis of data for more insights into health dynamics is required.

- Address staffing capacity in e-notification for the surveillance system.

- Integrate location information [geographic information system (GIS)] in Al-Shifa to enhance data analytics such as understanding of disease patterns.

- Improve system linkages for private hospitals with several branches (i.e. data shared only by submitting manual requests).

3. Strong institutional analytical capacities

Strengths

- Key statistical publications such as annual reports.

- Biostatistics degree in Sultan Qaboos University and the biostatistics course in Oman College of Health Sciences.

- Training in ICD coding and a curriculum on nursing informatics.

- Library facilities equipped with access to relevant resources are available in training institutions and public hospitals.

- Use of the Workload Indicators Staffing Needs tool in the health sector.

- Information management staff running the Al-Shifa system at different levels.

- High level of computer use and literacy throughout the Al-Shifa system and other data reporting and analysis tools.

3. Strong institutional analytical capacities

Potential areas for improvement

- Capacity of staff at all levels to analyse and use data for decision-making.
- Electronic access of Al-Shifa data for research.
- Roadmap for implementation of open data policy.
- Promoting the use of the Nabdh Al-Shifa analytic dashboard subject to availability of sufficient software licences.
- Policies on archiving and retention of electronic patient records to reduce challenges related to storage space when records have to be stored indefinitely, without clear direction, for their lifetime.
- Estimation of Health Adjusted Life Expectancy and Disability Adjusted Life Years using relevant population-based data sources (e.g. burden of disease) to effectively respond to these emerging needs.
- Metadata for standard indicators for monitoring and evaluation on programmatic needs.
- Generating relevant data to monitor universal health coverage, with a specific focus on measuring effective coverage and quality of services provided in both the public and the private sector.
- Staffing capacity in training institutions.
- Internet connectivity in selected parts of the country.

4. Mechanisms for data use, review and action

Strengths

- Regular data checks to inform planning.
- Culture of evidence-based decision-making.
- Annual review of data at the national level.
- Implementation of quality assurance guidelines.
- Comprehensive data visualization and dissemination mechanisms (e.g. Nabdh Al Shifa dashboard, Qlik Sense), including infographics and video clips which highlight key health issues or outcomes.
- Centre for Research and Studies in the Ministry of Health.
- Research and ethics committees at the national level which provide guidance on priority areas of research to generate evidence for decision-making.

Potential areas for improvement

- Quality and process indicators and key performance indicators.
- Adequate skilled staff in data science and bioinformatics.
- Promoting production of status reports using standard indicators in and across health facilities that focus on output, outcome and process.
- Promoting training on data use, reporting and monitoring and evaluationagainst set targets.
- Analysis of data at regional or local level to enable relevant decision-making within the context of regional or local dynamics.
- Sharing of (student) research findings with the Centre for Studies in the Ministry of Health.

4.4   Scoring health information system attributes

The assessment tool was presented in a plenary session; participants were then divided into the following four working groups to score the 71 attributes of the checklist:

- *Group 1:* Sound policy and institutional environment and effective country mechanisms for review and action.

- *Group 2:* Well-functioning data sources related to a routine HIS.

- *Group 3:* Well-functioning data sources related to household surveys, censuses and CRVS, and strong institutional capacity for data collection, management, analysis, use and dissemination

- *Group 4:* Well-functioning data sources related to disease surveillance and health systems.

Fig. 2 presents the results of the scoring of the 71 attributes in percentages with the number of attributes for each category presented in the parentheses. Complete scoring results for each

component (by working group) are presented in Annex 2.

The results of the assessment show that almost 9% (*n* = 6) of the attributes need a lot of strengthening, meaning that, although key attributes of a well functioning HIS are in place, there is still significant room for improvement. This includes key strategic areas such as active involvement and support of civil society actors and the synthesis and analysis of all national data from all relevant sources using a collaborative approach involving the Ministry of Health, the Centre for Statistics and Information and technical experts, including the public and private sectors. Other key areas that need significant strengthening include ensuring that enough staff are available at all levels to conduct public health surveillance and response and having routine recording systems in place for tracking private and public health expenditures (e.g. private insurance).

Almost 50% (*n* = 35) of the attributes need some strengthening; this includes strategies and resources to develop a comprehensive, costed monitoring and evaluation plan for the national health sector strategy; and ensuring that the monitoring and evaluation plan includes a framework that specifies a balanced and limited
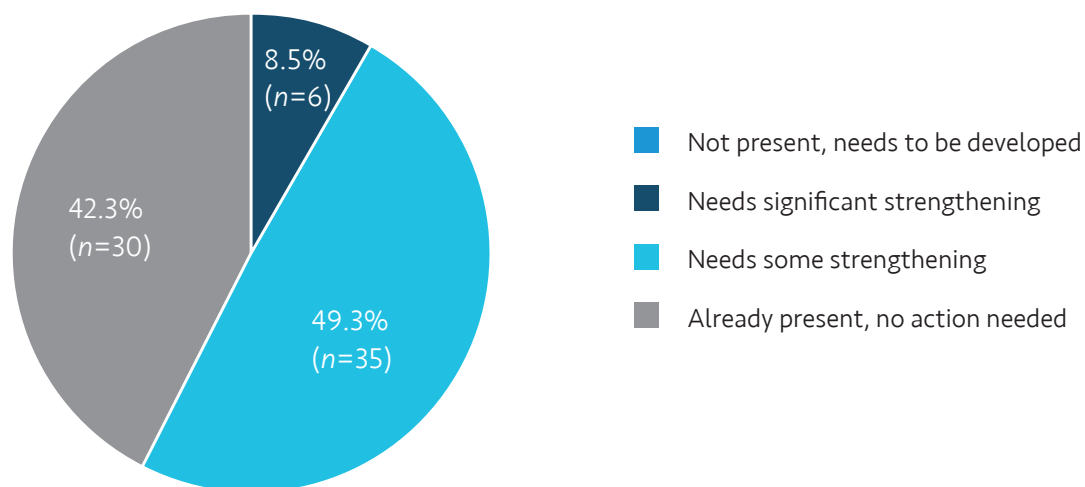

■ Not present, needs to be developed

■ Needs significant strengthening

■ Needs some strengthening

■ Already present, no action needed

Fig. 2. Summary of scores from the assessment and planning tool

set of core indicators with well-defined baselines, targets, frequency of measurement and data sources. Efforts are also required to develop standard operating procedures that define roles and responsibilities for collecting, managing and disseminating health data, including confidentiality. Health information flows in Oman's HIS also require improvement, including regular feedback and the use of data locally to improve services and programmes, institutionalization and independent data quality assessments for the routine HIS, and improved quality of data on cause of death. The country will also enhance the regular implementation of population-based surveys by developing an integrated national survey plan.

Finally, just over 42% (n = 30) of the total attributes were already present. These include the availability of agreed indicators, means of measurement and targets for monitoring and evaluation of the health-related SDGs; effective supportive supervision for the HIS; the availability of a comprehensive list of health facilities with unique facility identifier and geocodes; and the recent (2013) comprehensive assessment of CRVS performance. Other areas that are well established include the timely publication of annual population estimates for various demographic and geographic groups; the availability of a list of priority diseases and syndromes under current national surveillance; and adequate capacity to diagnose and record cases of notifiable diseases.

A detailed table with a summary of the scores by attribute and component of the monitoring and evaluation platform is presented in Annex 3. The priorities that emerged from the field visits, meetings and the national workshop have also been included into the roadmap (Section 6).

4.5   Enhancing information technology solutions

During the field visits, the assessment team also focused on the current technology dimension of existing systems and Al-Shifa in particular. Several key strengths and potential areas for improvement were identified and have been highlighted in Table 1. To a large extent, the focus is for Oman to upgrade its system and ensure that the legal and policy framework for information technology architecture is consistent with the national health vision. This can be achieved in several ways, such as updating current connectivity, enhancing security standards, and implementing systems that promote integration and linkages. While achievements have been made in securing a comprehensive Al-Shifa system, there is also a need to develop the system fully on open source platforms and with enhanced data analytics and artificial intelligence functionalities.

5. Roadmap of key priority actions

Based on observations from field visits, meetings with relevant stakeholders, results from the HIS assessment tool and discussions during the national workshop, a number of priority actions for enhancing the national HIS were identified. These actions, including the tentative time frame, responsible actors and other key actors needed for implementation, are presented in Table 2.

6. Next steps

Enhancing HIS operations in Oman requires a consolidated plan aimed at detailing the key HIS components: the expected output, financial cost, responsible stakeholders and key recommended areas for improvement. Improving HIS operations in the country can be achieved through the involvement of all stakeholders. The ideal approach is to also develop a strategic plan that highlights the existing strengths and opportunities and builds on the information provided in Section 5 on Key findings, and including the priority actions detailed in Section 6.

As countries work towards achieving the health-related SDGs, the development of a seamless and well-integrated HIS is the ultimate goal for any country. The priority actions should provide additional information to enhance operations. Updating short-, mid- and long-term plans for HIS strengthening should be an overarching priority. The focus should be on implementing interventions that can enhance HIS operations without much change. Key interventions should be costed based on the type of intervention, the estimated person/days, and any other additional materials or equipment needed.

Updating the existing national HIS strategy should be aimed at preparing the HIS to generate data that can be used to report on the core health indicators that were not being reported to WHO at the time of the assessment. The priority actions documented in this report can yield significant results if their implementation builds on the interventions and efforts of the Ministry of Health and other development partners. This approach is consistent with global strategies aimed at forging inclusive partnerships of international agencies, governments, philanthropies, donors and academics with the common aim of improving health data. While the public sector is distinct from the private sector in Oman, the new private national insurance scheme, which is under way, may have broad impacts on health information management. Therefore, periodic reviews of functionality should be integrated into national HIS-related work plans. In addition, systems such as Al-Shifa and which are built nationwide are generally quite rare: ensuring that the Ministry of Health continues to keep ownership of this system would be ideal.

Table 2. Key priority interventions to enhance the health information system in Oman

Roadmap of key priority actions			Chronogram				
Strategic dimensions	Key priority actions	Responsible/ other actors	2021	2022	2023	2024	2025
Policy, governance and institutional environment	Establish a fully structured national health council to support legal and policy frameworks related to HIS improvements	Ministry of Health/WHO	√	√			
	Establish a unifying electronic monitoring system to regularly monitor progress and quality control at the facility level	Ministry of Health/WHO	√				
	Develop and regularly update a common investment framework and inventory of partners' investments to streamline support for HIS improvements	Ministry of Health/WHO	√				
	Align disease- and programme-specific monitoring and evaluation mechanisms, including indicators, with the national monitoring and evaluation plan	Ministry of Health/WHO	√				
	Update the terms of reference of the national coordination committee responsible for the monitoring and evaluation of progress in achieving set targets at the national level	Ministry of Health/WHO	√				
	Develop mechanisms for standardization and interoperability and research and evaluation of e-health.	Ministry of Health/WHO	√	√			
	Finalize and approve standard operating procedures to facilitate inter- and intrasectoral data management and information exchange, and storage and dissemination of data	Ministry of Health/WHO	√	√			
	Develop a comprehensive timeline and identify the resources needed to implement extensive real-time integration and interoperability of tools and systems between all key health actors and service providers (public and private)	Ministry of Health/WHO/ other partners	√	√	√	√	√
	Consistent with the 71st World Health Assembly digital health resolution (A71/A/CONF./1), build an investment case by conducting case studies of Al-Shifa on how to perform data analysis and national reporting on a comprehensive real-time national data set	Ministry of Health/WHO	√	√	√		
	Update a unified national HIS strategy/ action plan	Ministry of Health/WHO/ other partners	√				
	Introduce and build capacity of staff in e-notification in private facilities	Ministry of Health/WHO	√	√			

Table 2. Key priority interventions to enhance the health information system in Oman (cont.)

Roadmap of key priority actions			Chronogram				
Strategic dimensions	**Key priority actions**	**Responsible/ other actors**	**2021**	**2022**	**2023**	**2024**	**2025**
Routine health information systems	Institutionalize Al-Shifa system as a hospital management information system across the private sector	Ministry of Health	√	√			
	Support capacity-building of private health sector staff on statistical skills to enhance quality of data at the national level	Ministry of Health/WHO	√	√	√		
	Implement recruiting mechanisms to increase the number of coders in the public and private sectors	Ministry of Health	√	√	√	√	√
	Build capacity of community level health workers in basic data collection methods and analysis	Ministry of Health/WHO	√	√	√		
	Build capacity of health information supervisors, doctors and paramedical staff to manage and analyse big data sets	Ministry of Health/WHO	√	√	√	√	√
	Digitalize feedback mechanisms from private health facilities to enable programme managers to monitor progress through dashboards	Ministry of Health/Private Health Facilities Association	√	√	√	√	√
	Develop and implement an e-learning system in relevant modules to improve capacity of staff	Ministry of Health/WHO	√	√	√	√	√
	Develop policy to enforce compulsory use of a unique patient identifier (biometric, civil ID or medical record number) across all health institutions (public and private)	Ministry of Health	√	√			
	Upgrade existing infrastructure for health institutions to enable seamless connection with Al-Shifa	Ministry of Health/ Directorate General Information Technology/ WHO	√	√	√		
	Develop and implement standardized indicators for the private sector to use in reporting to improve health care services and availability and quality of data at the national level	Ministry of Health/WHO	√	√			
	Implement regular review mechanisms of data at the national and governorate level using quality assurance, programme managers and health information officers	Ministry of Health/WHO	√	√	√	√	√
	Develop a unified mechanism to implement an electronic facility auditing system to regularly monitor progress and quality control	Ministry of Health/WHO	√	√	√	√	√

Table 2. Key priority interventions to enhance the health information system in Oman (cont.)

Roadmap of key priority actions			Chronogram				
Strategic dimensions	Key priority actions	Responsible/ other actors	2021	2022	2023	2024	2025
Routine health information systems	Develop mechanisms to enhance functionality of the e-notification system to support calculation of indicators on coverage and control of noncommunicable diseases in line with universal health coverage reporting requirements	Ministry of Health/WHO	√	√	√	√	√
Health systems monitoring	Establish routine recording systems for tracking private health expenditures	Ministry of Health/WHO	√	√	√		
	Build capacity of staff in data management, analysis and use with a focus on health system quality indicators	Ministry of Health/WHO	√	√	√		
	Establish mechanisms to use the results of health accounts to inform national and subnational planning processes	Ministry of Health/WHO	√	√	√		
Surveillance	Enhance electronic linkages between different health institutions (non-Ministry of Health and private health facilities) and Ministry of Health for exchange of patient data	Ministry of Health/private health facilities association/ Directorate General Information Technology	√	√	√		
	Establish coordination mechanisms between Ministry of Health and other entities such as the National Centre for Information and Statistics to exchange selected datasets such as geographic information system (GIS), socioeconomic status and other demographic characteristics	Ministry of Health/ National Centre for Statistics and Information / WHO	√	√	√		
	Develop national standardized framework for noncommunicable disease indicators	Ministry of Health/WHO	√	√	√		
	Provide sufficient human resources positions to perform expected public health surveillance and response activities	Ministry of Health/WHO	√	√	√	√	√
	Enhance capacity of staff at all levels to support retrieval of data for effective response	Ministry of Health/WHO	√	√	√	√	√
Household surveys and censuses	Develop a national integrated strategy to guide implementation of population-based surveys (i.e. survey plan) outlining rules and responsibilities for all key stakeholders	Ministry of Health/WHO	√				
	Develop mechanisms to enhance dissemination of results obtained from national population-based surveys	Ministry of Health/WHO	√	√			

Table 2. Key priority interventions to enhance the health information system in Oman (cont.)

Roadmap of key priority actions			Chronogram				
Strategic dimensions	**Key priority actions**	**Responsible/ other actors**	**2021**	**2022**	**2023**	**2024**	**2025**
Civil registration and vital statistics	Develop mechanisms to ensure completeness of death registration for deaths occurring outside facilities or national borders	Ministry of Health/WHO	√	√	√	√	√
	Build capacity of staff on reporting cause of death and ICD coding	Ministry of Health/WHO	√	√	√	√	√
	Develop a transition plan from ICD-10 to ICD-11, including a plan to implement the International Classification of Health Interventions	Ministry of Health/WHO	√	√	√	√	√
	Implement curriculum on cause of death coding in medical school	Ministry of Health/WHO	√	√	√	√	√
Analysis, use and dissemination of data, including mechanisms for review and action	Build capacity of staff in data analysis and report writing	Ministry of Health/ National Centre for Statistics and Information / WHO	√	√	√		
	Improve capacity of staff through training to develop policy briefs to enhance use of information for decision-making	WHO/ Ministry of Health		√			
	Scale up data storage and management systems, including Big Data analytical tools in line with the growth of information storage and retrieval needs	Ministry of Health/ National Centre for Statistics and Information / WHO	√	√	√		
	Ensure continuous development and planning for relevant and additional modules in Al-Shifa system for data analytics, machine learning and artificial intelligence libraries	Ministry of Health/WHO/ other partners	√	√	√	√	√
	Conduct joint annual health reviews for all stakeholders, in collaboration with national and international partners	Ministry of Health/WHO/ other partners	√	√	√	√	√
	Develop a strategy to engage civil society in areas related to the HIS and data at the national level	Ministry of Health/WHO/ other partners	√	√			
	Establish committees at the facility level to oversee data collection and support data utilization at the facility and community levels	Ministry of Health/WHO/ other partners		√	√	√	√
	Develop customized dashboards to extract information regularly from Al-Shifa to assess service readiness and availability	Ministry of Health/WHO/ other partners		√	√	√	√

Table 2. Key priority interventions to enhance the health information system in Oman (cont.)

| Roadmap of key priority actions			Chronogram				
Strategic dimensions	Key priority actions	Responsible/ other actors	2021	2022	2023	2024	2025
Analysis, use and dissemination of data, including mechanisms for review and action	Develop a plan for enhancing data to action, i.e. to enhance evidence-based decision-making	Ministry of Health/WHO	√	√	√		
	Enhance establishment and functionality of a national health observatory using the wealth of existing data at the national level	Ministry of Health/WHO/ other partners	√	√	√	√	√
	Establish feedback mechanisms within the Ministry of Health and between stakeholders using standard protocols	Ministry of Health/WHO	√	√			
Information technology	Deploy a reliable, high-quality, private government cloud (G-Cloud) once all the challenges related to network infrastructure in selected parts of the country are addressed	Ministry of Health/ Directorate General Information Technology	√	√	√	√	√
	Develop a new integration/migration plan to address existing fragmentation of information systems between different health programmes and other sectors	Ministry of Health/ Directorate General Information Technology	√	√	√		
	Develop a migration plan for Al-Shifa from the Oracle suite of products into a suitable open source database which should support both SQL/NoSQL modes	Ministry of Health/ Directorate General Information Technology	√	√	√	√	√
	Replace current fixed password login method in Al-Shifa with a more advanced multi-factor authentication method	Ministry of Health/ Directorate General Information Technology	√	√			
	Develop a fully automated and linked system across all facilities and data collection platforms to minimize duplications arising from paper-based registries and facilitate automatic report generation for decision-making.	Ministry of Health/ Directorate General Information Technology	√	√	√	√	√

Annex 1.   Key documents and forms reviewed for the assessment

- Al-Shifa health information system – synopsis
- Congenital anomalies and genetic disorders notification form
- Noncommunicable disease survey report 2017
- Oman's health information system review and assessment report 2008
- Oman National Nutrition Survey 2017
- Internal notification of birth form
- Notification of birth form
- Internal notification of death form
- Notification of death form
- Fetal death notification form
- Maternal death notification form
- Monthly inpatient morbidity and mortality statistical report, male
- Monthly inpatient mortality statistical report, male
- Monthly report on outpatient attendance
- Monthly dental morbidity report (new cases only), male
- Monthly dental morbidity report (new cases only), female
- Dental management report
- Outpatient morbidity report, male (new cases only)
- Outpatient morbidity report, female (new cases only)
- Monthly report for laboratory procedures
- Monthly report for diagnostic radiological procedures
- Ear health care monthly report
- Neonates screened for hearing disability monthly report
- Monthly report for child malnutrition
- Monthly statistical report from nutrition clinic, male
- Monthly statistical report from nutrition clinic, female
- Monthly statistical report on child nutrition feeding pattern
- Monthly reports of sexually transmitted infections (STIs) tested for HIV and syphilis
- Expanded Programme on Immunization (EPI) monthly report
- Monthly maternity report
- Child monthly report
- Antenatal care register survey – monthly summary report
- Monthly antenatal and postnatal report
- Infertility monthly report (parent institution)
- Premarital testing and counselling monthly report
- Birth spacing facility monthly summary report
- Rehabilitation in primary care
- Diabetes mellitus monthly report for newly diagnosed and registered cases (males, Omani)
- Diabetes mellitus monthly report for newly diagnosed and registered cases (males, non-Omani)
- Diabetes mellitus monthly report for newly diagnosed and registered cases (females, Omani)
- Diabetes mellitus monthly report for newly diagnosed and registered cases (females, non-Omani)
- Diabetes mellitus monthly report for old diabetic but newly registered cases (male, Omani)
- Diabetes mellitus monthly report for old diabetic but newly registered cases (male, non-Omani)
- Diabetes mellitus monthly report for old diabetic but newly registered cases (female, Omani)
- Diabetes mellitus monthly report for old diabetic but newly registered cases (female, non-Omani)
- Outpatient department deaths form
- Brought dead form (data on brought dead to the health institution)
- National noncommunicable diseases screening programme, ≥ 40 years age

- Eye health care monthly report
- List of medical equipment
- Report on prescriptions dispensed in Ministry of Health institutions
- Types of transitional beds in Ministry of Health institutions (hospitals and health centres)
- The National Elderly Care Programme for Omanis only (60 years and above) monthly data collection
- Community health nursing service – monthly statistics
- Hypertension monthly report for newly diagnosed and newly registered cases (male, Omani)
- Hypertension monthly report for newly diagnosed and newly registered cases (male, non-Omani)
- Hypertension monthly report for newly diagnosed and newly registered cases (female, Omani)
- Hypertension monthly report for newly diagnosed and newly registered cases (female, non-Omani)
- Asthma monthly report of newly registered cases (male, non-Omani)
- Asthma monthly report of newly registered cases (female, non-Omani)
- Asthma monthly report of newly registered cases (female, Omani)
- Asthma monthly report of newly registered cases (female, non-Omani)
- Physicians by category and specialty (Omani)
- Physicians by category and specialty (non-Omani)

Annex 2. Summary of scores by working group

Group 1. Policy and institutional environment

9.1%
27.3%
63.6%
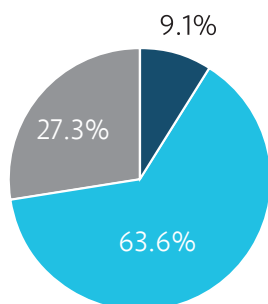
Group 1. Effective country mechanisms for review and action

33.3%
33.3%
33.3%
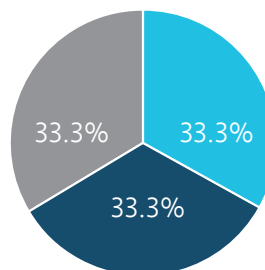
Group 2. Routine health information systems

41.7%
58.3%
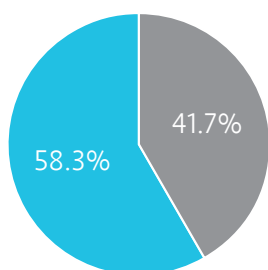
Group 3. Household surveys, censuses CRVS
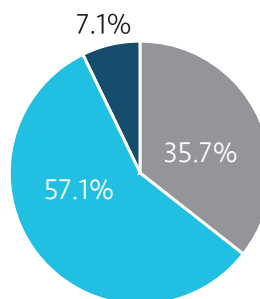
7.1%
35.7%
57.1%

Group 3. Strong institutional capacities

22.2%
33.3%
44.4%

Group 4. Disease surveillance

10% 10%
80%

Group 4. Disease surveillance

11.1% 11.1%
77.8%
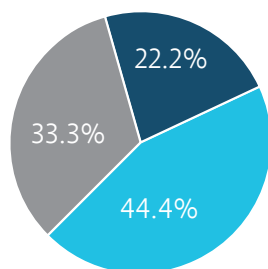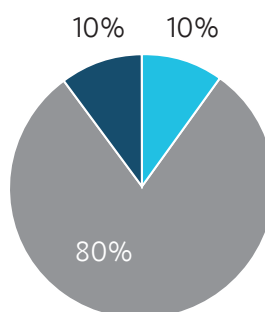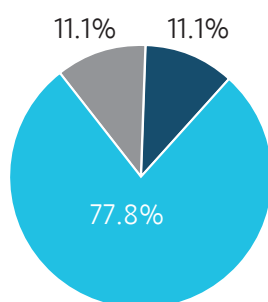
Key

■ Not present, needs to be developed

■ Needs significant strengthening

■ Needs some strengthening

■ Already present, no action needed

Annex 3. Results of the scoring exercise, distributed by component and attribute

The table below captures the results of the scoring exercise, by working group and attribute.

Component	Not present, needs to be developed	Needs significant strengthening	Needs some strengthening	Already present, further improvement is possible
Policy and institutional environment		An effective country-led coordination mechanism for monitoring and evaluation and review with active involvement and support of relevant development partners, civil society and other actors	There is a comprehensive costed monitoring and evaluation plan for the national health sector strategy The monitoring and evaluation plan includes a framework that specifies a balanced and limited set of core indicators with well-defined baselines, targets, frequency of measurement and data sources Disease- and programme-specific monitoring and evaluation mechanisms, including indicators, are aligned with the monitoring and evaluation plan A common investment framework is used as the basis for partner and domestic support There are agreed indicators, means of measurement and targets (developed in collaboration between relevant ministries and agencies) for monitoring and evaluation of progress towards the health-related SDGs There is a national policy/strategy for e-health and information and communications technology development and use, including governance and legal frameworks; enterprise architecture; standardization and interoperability; and research and evaluation on e-health Standard operating procedures have been written that define roles and responsibilities for collecting, managing and disseminating health data, including confidentiality There is an overall unifying health data architecture and health data collection standards	The monitoring and evaluation plan has been informed by a recent (< 2 years) assessment Up-to-date legislation and detailed regulations for health information, including all data sources. are in place

Component	Not present, needs to be developed	Needs significant strengthening	Needs some strengthening	Already present, further improvement is possible
Routine health information systems			There is adequate infrastructure and staffing for a functional routine HIS	Effective supervisions are in place (up-to-date checklist, resources)
			Local level decision-makers and community members analyse and use facility- and community-based information to develop responsive and appropriate service delivery strategies and community-based interventions	There is a comprehensive list of health facilities, with unique facility identifiers and geocodes
			Feedback is systematically provided to all sub-reporting units	Disease- and programme-specific data elements and indicators are integrated into the national common data repository
			There is adequate training and capacity-building for a functional routine HIS	There is a system for collection and use of patient management data at the point of service
			Facility reporting systems use web-based systems, when feasible	Data on community-based health programmes are available in formats that are easy to access and which are linked to facility-based databases
			There is a harmonized system of facility assessments to verify service delivery and quality of care	
			Regular and independent data quality assessments are institutionalized	

Component	Not present, needs to be developed	Needs significant strengthening	Needs some strengthening	Already present, further improvement is possible
Household surveys, censuses, CRVS		Use of verbal autopsy is being gradually expanded to generate nationally representative cause of death statistics	There are strategies and resources to strengthen the notification of births and deaths and medical certification of cause of death A functional multisectoral coordination committee is in place (National Statistics Office, Ministry of Health, etc.) Hospitals are reporting deaths, with cause of death, through medical certification using the ICD There is IT infrastructure for entering information on the deceased, including the cause of death by individual record Systems for the automated coding of cause of death are progressively used There are trained resources to conduct verbal autopsies Household surveys are conducted every 3–5 years to monitor progress on the key health indicators of the national health strategic plan There is adequate country level capacity for census and survey data collection, analysis, report writing and dissemination	A comprehensive assessment has been conducted of current CRVS performance There is up-to-date legislation and regulations for civil registration and vital statistics A coordination mechanism is in place to coordinate plans for the national census and national surveys There is a national survey plan and research agenda for household surveys detailing content, sequencing, periodicity and funding, aligned with the monitoring and evaluation plan and the National Health Strategy The National Statistics Office publishes timely and reliable annual population estimates for various demographic and geographic groups (e.g. live births, surviving infants, women of reproductive age by district)

Component	Not present, needs to be developed	Needs significant strengthening	Needs some strengthening	Already present, further improvement is possible
Disease surveillance		Adequate staff are available at all levels to conduct public health surveillance and response	Equipment and logistics (forms and registers, computers, telephones, communication, including Internet connectivity, cars and motorbikes) are adequate and disseminated appropriately in the country to conduct public health surveillance activities	Public and private health care facilities, laboratories and communities contribute to routine case detection
				The list of priority diseases and syndromes under current national surveillance is defined
				Standard case definitions are available for all diseases and syndromes under surveillance
				The country has adequate capacity to diagnose and record cases of notifiable diseases
				The time frame for verifying an event and to report weekly aggregated data is defined at all levels
				Data are analysed on a regular basis at each level to detect events involving cases or deaths above expected levels for the particular time and place
				Alert/action thresholds have been defined for priority diseases and syndromes
				All disease surveillance programmes have been integrated

Component	Not present, needs to be developed	Needs significant strengthening	Needs some strengthening	Already present, further improvement is possible
Health systems		There are country-specific routine recording systems for tracking private health expenditures (e.g. by nongovernmental organizations, enterprises, private, insurance, etc.) to replace health accounts annual surveys The health accounts results are used for policy planning and evaluation, from overall health system policies to health system financing policy specifically	There is a reliable and transparent system for tracking the aggregate availability of human resources and expenditure by public (non-Ministry of Health) health care providers. These aggregate data on human resources availability, by cadre and by health facility, are widely available for the purpose of assessing equity productivity There is an electronic registry (HRIS) with up-to-date data on each individual health worker, including a unique identifier, qualifications and key characteristics (name, birth date, sex, contact, place of work, etc.) Health expenditures are tracked on an annual basis, using the global standard of the System of Health Accounts 2011 (SHA 2011) There is a strong public financial management system tracking government budgets, disbursements and expenditures at all levels (from facility to central level) There is a logistics information system for tracking commodities, medicines, equipment and supplies "Health systems" information sub-systems are interoperable with, or have been integrated into, the health management information system	

Component	Not present, needs to be developed	Needs significant strengthening	Needs some strengthening	Already present, further improvement is possible
Strong institutional capacities			Strong analytical institutional capacity for supporting synthesis of data is in place Synthesis and analysis of national data from all relevant sources are conducted using a collaborative approach involving health ministries, national statistics offices, technical experts and the public and private sectors National public health and academic institutions, advocacy groups and the media are engaged by the Ministry of Health and CSA to disseminate key health information	• There is a regular (annual) report of progress and performance that covers progress against the objectives and targets, equity and efficiency • Health data are transparent and accessible • At national level, there are periodic performance reviews/analytic reviews based upon robust analysis of health data from all sources, including contextual and qualitative information International standards are followed for analysis and presentation of key indicators in order to ensure comparability of results between populations and over time There are effective processes to support analysis and use at the subnational level A range of dissemination strategies are in place for health information, censuses and vital statistics, including reports, policy briefs and web-based dissemination

Component	Not present, needs to be developed	Needs significant strengthening	Needs some strengthening	Already present, further improvement is possible
Effective mechanisms for review and action		Civil society organizations actively and meaningfully participate in country reviews of progress and performance at all levels	Results from reviews are incorporated into decision-making, including resource allocation and financial disbursement

There are systematic linkages between health sector reviews and disease- and programme-specific reviews | A regular and transparent system is in place covering reviews of progress and performance against national and locally defined priorities with the broad involvement of key stakeholders

Independent reviews of data in strategically important programmes, such as maternal, child and perinatal deaths, are conducted regularly

Health information flows include regular feedback and use of data locally to improve services and programmes |

Annex 4. Concept note for a national health observatory

Context

A potential strategic area discussed during the mission is the opportunity to develop a national health data observatory. To facilitate discussion and planning on this important area, the following points are critical.

Oman has demonstrated leadership in large-scale data repositories, data exchange and a normative approach to practices. The WHO has also supported countries to develop health data observatories and other countries have expressed an interest in doing so. These may serve as multi-stakeholder and collaborative structures and platforms, which can further support and facilitate the collection, processing, sharing, translation and application of information, evidence and knowledge to support national efforts towards improving national health systems and outcomes.

The following features are envisaged for a health data observatory:

▶ a web portal for easy access to the best available information, evidence and knowledge;

▶ a data statistics platform enabling data downloading, processing and analysis, or access to ready-made statistics at the national and governorate level;

▶ analytical national and governorate-level profiles in a collaborative space (e.g. based on wiki technology) allowing the production and updating of these profiles (the profiles would be based on both quantitative and qualitative information, and would be comprehensive, covering areas such as health systems, priority programmes, progress towards the SDGs, and key determinants of health);

▶ a platform and relevant tools that enable networking, collaborative work and learning within and between groups, communities of practice and institutions.

Rationale

Oman has a robust real-time data infrastructure accessible through open data standards and systems. The Ministry of Health is currently focused on the development of several business intelligence/analysis tools against the data repository landscape emanating from Al-Shifa and other systems. The country is also going to implement a national private health insurance scheme, tacitly mostly for non-Omani residents in the country. The country will have to work on data analysis and reporting cross-cutting all of these data sets. There is also an opportunity to develop tools accessible to stakeholders and even the general public to aid in showing unity across the population and a level of transparency. A key strategic objective for Oman in addressing cross-cutting issues such as universal health coverage could be establishing a health data observatory.

Goals, objectives and expected results

Using the same tools and approaches (e.g. based on the WHO Global Health Observatory)[13] work with Oman to integrate this framework to provide a data observatory in line with WHO norms and standards. Furthermore, the aim is to have within the observatory selected datasets to be accessible as a web service to WHO and other development partners as part of routine reporting of health-related statistical data sets and indicators.

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[13] Global Health Observatory: https://www.who.int/gho/

Once the observatory is developed, the expectation will be to achieve an operational model health data observatory which is populated through routine extracting, transforming and loading of data from existing sources within the country. The observatory will be a portal for Oman to showcase health situation for all residents in the country.

Innovation: how would this project be different?

Unlike the context in many countries where NHOs have been postulated, Oman clearly has the robust data infrastructure, skills and tools in place to make this project work based on real-time data. Before data are actually transferred into the observatory, the process of data cleaning/checking on these large data sets (which has to be carried out) will also extend an opportunity for innovative approaches in these health-related statistical technical areas.

This report presents the findings of a comprehensive assessment of Oman's health information system undertaken by WHO in 2019 at the request of the Ministry of Health. Health information systems, including civil registration and vital statistics systems, provide health information data for programme and performance monitoring, quality of care, planning and policy-making. The assessment resulted in a set of recommendations to enable the Ministry of Health and other stakeholders to develop comprehensive and efficient systems to monitor health risks and determinants; track health status and outcomes, including cause-specific mortality; and assess health system performance. The recommendations also provide an opportunity for the country to respond to the growing demands for health data to measure progress towards the health-related Sustainable Development Goals.