Comprehensive assessment of Jordan's health information system 2016

World Health Organization
REGIONAL OFFICE FOR THE Eastern Mediterranean

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WHO Library Cataloguing in Publication Data

World Health Organization. Regional Office for the Eastern Mediterranean

Comprehensive assessment of Jordan's health information system 2016 / World Health Organization. Regional Office for the Eastern Mediterranean

p.

ISBN: 978-92-9022-258-3

ISBN: 978-92-9022-259-0 (online)

1. Health Information Systems 2. Vital Statistics - Jordan 3. Health Status Indicators 4. Outcome and Process Assessment (Health Care) 5. Delivery of Health Care I. Title II Regional Office for the Eastern Mediterranean

(NLM Classification: W 26.55.I4)

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Acknowledgements

This report is the product of a review mission conducted by WHO for the Ministry of Health of Jordan. The contributions of all individuals who assisted the review team during the mission is gratefully acknowledged, in particular the Secretary General of Health and staff of the Ministry of Health who made themselves available for visits and answered the many questions asked by the review team. Special thanks are also extended to key staff from the Higher Health Council, Higher Population Council, Department of Statistics, United Nations Relief and Works Agency for Palestine Refugees in the Near East, the Civil Registration Authority, Electronic Health Solutions, Prince Hamza Hospital, Al-Hashimi Al-Shamali Comprehensive Medical Centre and Royal Medical Services.

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Abbreviations

ANACoD	Analysis of cause of death (tool for analysis)
CRA	Civil Registration Authority
CRVS	Civil registration and vital statistics
DCD	Division of Communicable Diseases
DHS	Demographic and health survey
EHS	Electronic health solutions
EMR	Electronic medical record
HIS	Health information system
HMN	Health Metrics Network
HSD	Health systems development
IACR	International Association of Cancer Registries
IAEA	International Atomic Energy Agency
ICD	International Classification of Diseases
ICT	Information and Communications Technology
IER	Information, Evidence and Research
IERS	Integrated electronic reporting system
MoH	Ministry of Health
NCD	Noncommunicable diseases
NGO	Nongovernmental organization
NMH	Noncommunicable Diseases and Mental Health
RMS	Royal Medical Services
ToR	Terms of reference
WHO	World Health Organization
UNHCR	United Nations Office of the High Commisioner for Refugees
UNICEF	United Nations Children's Fund
UNFPA	United Nations Population Fund
UNRWA	United Nations Relief and Works Agency for Palestine Refugees in the Near East
USAID	United States Agency for International Development
VistA	Veterans Information Systems and Technology Architecture
SQL	Structured Query Language
SDGs	Sustainable Development Goals

Executive summary

Health information systems (HIS), including civil registration and vital statistics (CRVS) systems, are vital sources of health information data for evidence-based planning, monitoring, policy-making, and other areas. HIS and CRVS systems are the only sources that provide continuous information on the coverage of services in the health sector. The availability of HIS data at the subnational level provides countries with an opportunity to assess equity in the provision of health services.

This assessment was commissioned by WHO in October 2016 at the request of the Ministry of Health (MoH) in Jordan to support the Ministry in strengthening the current systems that provide health-related information, considering the broader role of HIS in responding to the Jordan 2025 National Vision and Strategy. In October 2016, a team of international consultants collaborated with WHO and the MoH to review the key systems. These include institution-based systems used to manage service delivery, that collect information on users of services and the resources required to provide the services; and population-based systems, such as census, vital events, and health surveys, that provide information on the health status and behaviour of the entire population. Information from both types of systems is essential to improve health status and health system performance.

In Jordan, as in many countries, population-based systems follow international quality standards, while institution-based systems usually require strengthening to conform to these standards and to support improvement in health system performance. During the assessment of Jordan's HIS, the review team focused on identifying options to strengthen population-based and institution-based systems. There were five key thematic areas for the HIS review: governance structures; infrastructure and support; data management and standards; quality assurance; and dissemination and data use.

In this review, the main strengths observed in the HIS in Jordan include: the existence of a functional Directorate of Information and Studies under the Department of Planning and Administration that coordinates HIS activities; the growing demand for health-related information from senior programme managers, policy-makers, donors, NGOs and other key players in the health sector for health-related Sustainable Development Goals (SDGs); and a well-defined system of data collection and reporting from the facility up to the national level. The team also observed that most units supporting the HIS report information frequently and timely and that there are well-defined catchment areas and administrative boundaries. Information from census and surveys conducted by the Department of Statistics and other partners is regularly used. The National Health Strategy (2015–2019) also provides an agenda that makes strengthening of HIS inevitable. The strong Notifiable Disease Surveillance System and population-based cancer registry are some of the key attributes of Jordan's HIS. The fully automated vital registration system is also one of the key data sources.

Governance

- The HIS can be strengthened and respond to national development needs by ensuring that the role of the MoH is clear as the leading entity for HIS and coordinator for HIS-related activities in collaboration with relevant stakeholders. This can be done through a functional national steering committee in charge of HIS coordination. The committee will have representation from relevant stakeholders on HIS and respond to strategic issues related to HIS.

- The Information Technology and Information Studies Directorates should be strengthened and supported in setting standards for data collection, processing, dissemination and use.

- Unified HIS short- and long-term strategic plans should be developed, including clear priorities for action and responsibilities to guide implementation of activities. The strategic plan should address all major data sources described in the Health Metrics Network (HMN) Framework (censuses, civil registration,

population-based surveys, individual records, service records and resource records) and its implementation at the national level.

- A national surveys strategic plan can be developed that aims at coordinating with other stakeholders and setting priorities for household surveys.

Infrastructure and support

- The HIS functionality and effectiveness should be enhanced based on MoH needs and WHO standards. This can be achieved by ensuring that all disease surveillance forms and reports, including the death notification form, are coded into the interactive electronic reporting system (IERS) in order to standardize and speed up data collection and reporting.

- The MoH should strengthen and support the Directorate of Information Technology to provide the state-of-the-art information and communication technology infrastructure for an effective HIS.

- Inadequate human resources – a common problem across the entire ministry – to implement quality assurance procedures has led to delays in releasing information to the MoH, thereby affecting timely release of annual reports. A human resource structure for the health information department from the health facility to the headquarters should be developed.

- The capacity of IERS should be improved to produce the WHO/International Society of Hypertension risk prediction charts.

Data management and standards

- Guidelines and standardized operational procedures should be developed or harmonized for data management (data collection, storage), analysis, reporting, dissemination and utilization. In addition, national health indicators metadata and agreed data sources should be developed to guide data collection, processing, and analysis.

- A data repository should be developed for the entire HIS to enable data extraction, linkage, triangulation with other sources such as population-based data (e.g. census) and institution-based data (e.g. service records) and compiled into usable statistics and information for in-depth analysis and comparison of various heath indicators. Thus, information from non-routine sources and routine sources would provide data into the repository. While IERS is acting as a data repository to collect data from other sources (e.g. UNHCR, refugee camps and Hakeem), developing or transforming it into a data repository for the entire HIS, and including data from other sources) is inevitable.

- The capacity of the Hakeem system can be improved to automatically generate statistical/analytical reports and also provide data on noncommunicable diseases (NCDs), such as heart disease, chronic respiratory disease and diabetes.

- IERS should offer complete national coverage as a surveillance tool as well as a tool for collection of causes of death from health facilities.

- Possibilities should be explored to integrate IERS with facilities covered by Hakeem.

Quality assurance

- A clear mandate should be established across all the systems in terms of minimum standards for data quality assurance systems.

- Supportive supervision mechanisms and refresher training are important and should be tailored to managing information systems and their staff.

- To avoid data discrepancies, definitions and methodologies should be standardized when the same data elements or indicators are used, collected or derived across different systems and programmes.

- IERS data collection should be expanded on risk factors (physical activity and diet). The expansion

should include collection of data on NCDs to include specific information on cardiovascular risk disease.

Data dissemination and use

- National health information standard operating procedures or guidelines should be developed for dissemination of health data across and within users and producers.

- Dashboards and other strategies should be developed to increase access to health data and information by policy- and decision-makers through improvement in data storage, retrieval, analysis and presentation. While IERS produces dashboards for communicable diseases, noncommunicable diseases and mental health, there is a need for comprehensive HIS dashboards with integrated data collected from population-based data sources (census, civil registration, population-based surveys) and institution-based data sources (individual records, service records and resource records).

- The possibility to integrate IERS with facilities covered by Hakeem should be explored.

Challenges associated with technical fragmentation can easily be addressed. However, this must be supported by institutional and departmental linkages within the MoH. The key step in strengthening HIS is to establish a national steering committee responsible for coordinating activities by multiple departments within the MoH, other ministries and external partners. The HIS national steering committee should be guided by the MoH strategy, and the Higher Health Council is the ideal structure for support. Considering the existing information needs and the increased HIS activity involving multiple partners in the future, the development of a MoH HIS strategy would mobilize support and coordinate the work of several technical working groups. With the national steering committee on the one hand and the MoH HIS strategy on the other, improvement strategies would include development of: 1) a core indicator list for HIS and surveillance systems; 2) standard operating procedures and guidelines to support system integration; and 3) a human resources plan. These would lead to improvement of the national HIS infrastructure and the national HIS data repository for data analysis, dissemination, and use. Conducting periodic HIS assessments and reviews would be ideal in ensuring that the systems are functioning according to expected standards set by the HIS strategy. The efforts and investments to improve the HIS can be coordinated in the context of the overarching 2025 National Vision and Strategy, the National Health Strategy (2015–2019), and the MoH's internal strategy (2013–2017). The Higher Health Council and the MoH, guided by the National Health Strategy, should mobilize support for consensus-building in defining the primary goals and interventions to improve the HIS.

An important step will be for the MoH and other stakeholders to vet the findings and recommendations of this assessment and align them with their analysis and final direction, to make them part of a single agreed set of recommendations that can be integrated to develop an HIS strategy, policy, and operational/action plans. Recognizing the achievements made by IERS, the assessment team believes that to unify and integrate the HIS it will require that the MoH take a leading approach by strengthening the Directorate of Information and Studies along with the continuous and coordinated commitment from all stakeholders and other MoH departments. Implementation of the recommendations contained in this report will enable Jordan to create an HIS that will, among other things, help decision-makers engage in effective policy discussion, monitor and plan how to deal with health problems, address inequities, and improve governance and accountability across the health sector.

1. Introduction

1.1 Overview of the health sector in Jordan

The Jordanian health sector has developed into a relatively modern health system that provides a range of both advanced medical services and basic primary health care to most citizens at comparatively low direct costs to the patient. The main public health care providers are the Ministry of Health (MoH), Royal Medical Services (RMS), and the university hospitals (Jordan University Hospital and King Abdullah University Hospital). In addition, there are a number of specialist health care providers, including the King Hussein Cancer Center. The MoH manages the Civil Insurance Program which is the main health insurance programme for civil servants. The RMS manages the Military Insurance Fund which covers health care for military staff and other people including high-ranking officials. Services from the public health sector are complemented by the private sector, which includes both private for-profit and not-for-profit (NGOs) mostly working in peripheral areas. Moreover, the United Nations Relief and Works Agency for Palestine Refugees in the Near East (UNRWA) also provides health care services throughout Jordan.

Jordan's MoH service delivery is established at three levels: primary, secondary, and tertiary. According to the *2015 Annual Statistics Report*, there were 104 hospitals with a total of 13 115 beds. About a third of all hospital beds (4350) were in the private sector. There were 14 beds per 10 000 population in Jordan in 2015. However, the distribution of hospital beds is not equitable with a rate of as high as 18 beds per 10 000 population in Amman and as low as 5 beds per 10 000 population in Mafraq governorate. Primary health care (PHC) is the main vehicle through which health care programmes are implemented in Jordan.[1] The PHC centres include comprehensive health centres, regular health centres, peripheral health centres and 460 maternal and child health centres. In addition, there are over 400 dental clinics in Jordan. In 2015, there was one PHC centre (different types) per 8300 persons, much higher than the standard rate of one PHC centre per 5000 population. There were 22.2 physicians, 7.1 dentists, 24.8 nurses, and 12.7 pharmacists per 10 000 population.

Jordan public health indicators have improved considerably since the mid-1990s and the country has one of the best health care systems in the Eastern Mediterranean Region. Despite these achievements, a number of challenges remain such as the flow of Syrian refugees into Jordan which continues to place increasing demands on health service delivery. Jordan has also experienced a significant epidemiological shift in recent years towards noncommunicable diseases as a major cause of morbidity and mortality (WHO 2015). A key strategy to respond to these challenges is strengthening the HIS to enable the generation of timely and reliable evidence for assessing the health situation and trends.

1.2 Health information systems assessment

Health information systems (HIS), including civil registration and vital statistics (CRVS) systems, are indispensable sources of health information data for programme monitoring, performance monitoring, quality of care, planning, and policy making. HIS and CRVS systems are the only information sources that provide continuous information on the coverage of services in the health sector. The availability of HIS data at the subnational level provides countries with an opportunity to assess equity in the provision of health services (Health Metrics Network 2008).

While HIS data offer many opportunities to assess various aspects of the health system, the data are often not of high quality; this negatively affects the use of a rich source of health sector data. Quality of data may be influenced by a number of factors such as missing values on vital records (e.g. births, deaths), inconsistency in reported information or

[1] MoH statistics for 2015 show that there were a total of 1135 PHCs distributed as follows: 99 comprehensive health centres, 378 primary health centres, 198 secondary health centres (hospitals), and 460 maternal and child health centres (http://apps.moh.gov.jo/reports/headermain.jsp?firstjsp=hcadmain&lang_parameter=english).

undercount of selected populations or groups of people. Any health system reform and intervention will need to rely on reliable information or data and be accompanied by a comprehensive monitoring and evaluation plan that relies on a reliable and integrated HIS (i.e. that draws on and links data from various sources such as census, surveys, or other facility-based records). In order for the HIS to support the health system strengthening objectives, it needs to avoid parallel reporting systems where possible, support single reporting channels, and ensure that feedback from data and analysis is communicated effectively. In Jordan, the Directorate of Information and Studies collects routine health information from the MoH facilities and other public and private hospitals. The Directorate of Information and Studies produces the MoH annual report which is considered the main source of information about health services, including human resources. A National Cancer Registry collects and reports morbidity data using International Classification of Diseases (ICD-10) coding.

At the request of the MoH in Jordan, WHO commissioned an assessment of the HIS in October 2016 to support the MoH in strengthening the health information system. A team of international consultants collaborated with WHO and the MoH to conduct the assessment. The terms of reference for the assessment specified that the report provide a description of the HIS, including: overall HIS structure within the MoH, civil registration authority/Ministry of Interior and externally; information flow, governance and quality assurance; infrastructure; data management and standards; dissemination and use of data for policy and planning; analysis of its strengths and weaknesses; and recommendations on how to further develop the system to respond to emerging needs such as responding to the refugee population challenges. The terms of reference also highlighted the importance of HIS strengthening in the broader context of the role of HIS in responding to the Jordan's 2025 National Vision and Strategy.

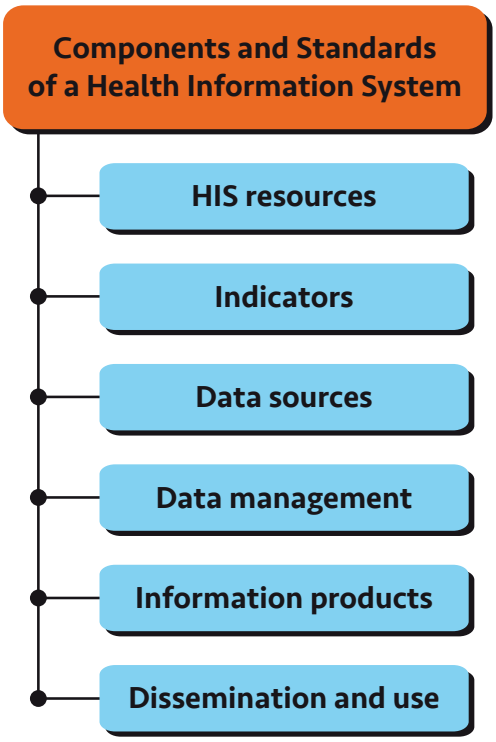
This report has four main sections:

- *Conceptual framework and assessment methodology.* The Health Metrics Network (HMN) Framework describes what makes a system effective, how each part of the system can be evaluated, and the strategies that help countries build strong and effective HISs.
- *Findings on HIS.* A number of different information systems were identified and their information was reviewed. This section builds on the HMN assessment framework by focusing on the strengths and weaknesses of the governance structures; infrastructure and support; data management and standards; quality assurance; and dissemination and data use.
- *Recommendations.* Based on both Jordanian and international experience, this section highlights what can serve as a foundation for the future without much change: that is, what needs strengthening, and what needs to be added to ensure that the HIS responds to the Jordan 2025 National Vision and Strategy.
- *Next steps.* How should the ideal HIS look in the future? What are the priorities for reaching these goals to build an effective system that is responsive to Jordan's development indicator needs and the Sustainable Development Goals? Responses to these questions are synthesized in this section.

2. Conceptual framework and assessment methodology

2.1 The Health Metrics Network Framework

The HMN Framework identifies six key components of a standard HIS (Fig. 1) that help countries develop their own HIS in a way that empowers all those who contribute to and benefit from health information. These six components are summarized into three categories: inputs, processes, and outputs. The inputs include all the HIS resources (i.e. the physical and structural prerequisites of an HIS). The processes include indicators, data sources, and data management. The HIS outputs ought to be relevant, accessible, and useful evidence for decision making. These outputs are information products that should be disseminated and used by policy-makers and



Source: HMN Framework (second edition 2008)

Fig. 1. Components and standards of a health information system

the public (Health Metrics Network 2008). For the assessment, the six components are summarized or grouped into: governance structures; infrastructure and support; data management and standards; quality assurance; and dissemination and data use (Fig. 2).

Thus, a well-performing HIS is expected to utilize data (see Fig. 3) and produce relevant information that can be used for making transparent and evidence-based decisions for health system interventions. HIS performance should therefore be measured along several dimensions: quality of data produced, evidence of continued use of data to improve health system performance, and response to emergent data needs and to improve health. In other words, the role of the HIS is not simply technical data processing; it must also stimulate and support use of the information to support decision-making.

Data from the different HIS sources support different decision-making processes in health policy formulation, planning and implementation. Population-based systems such as surveys and CRVS provide data for the entire population – its overall health status, access to health services and other needs. Institution-based systems provide information about immediate and emerging operational issues. Institution-based information comes from a subset of the whole population, but if more institutions participate in the institution-based system of information, changing trends in

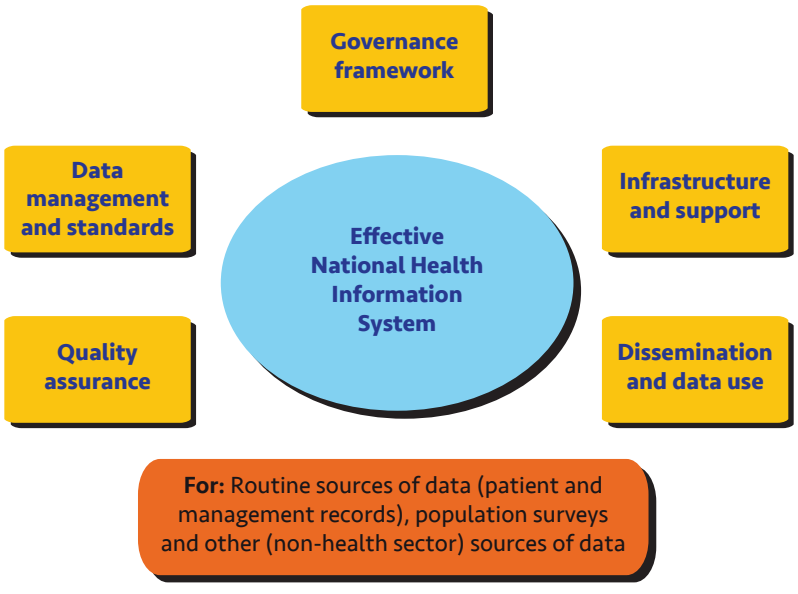
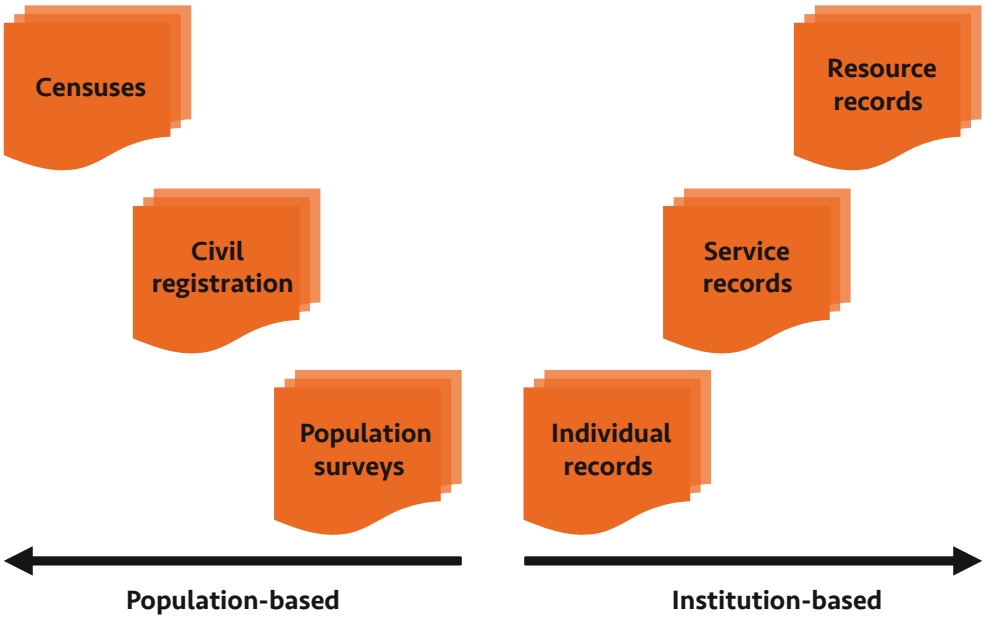


Fig. 2. Effective national health information system



Source: Health Metrics Network

Fig. 3. Health information system data sources

service uptake and outcomes often reflect similar changes at the national level. While comprehensive policy-monitoring requires population-based information, institution-based information can be used for more frequent monitoring of some effects of policy implementation.

2.2 Assessment methodology

The review team focused on an approach that aimed at: developing common understanding of available information systems and databases; assessing the strengths and weaknesses of these components and operations within the HIS; and providing recommendations consistent with WHO and HIS standards, indicator frameworks and guidelines.

2.2.1 Document reviews

Before the mission, the team reviewed documents provided by the MoH, other stakeholders, and documents available in the public domain. Some documents were also received during meetings and field visits.

2.2.2 Observations and meetings

Over the four days of the mission, the team made several observational visits that were focused on learning about specific information systems and held group meetings with a large number of informants, focusing on information systems directly relevant to the MoH interests. The team worked with 15 departments and directorates of the MoH. Meetings were also held with the Higher Health Council, Higher Population Council, Jordan Department of Statistics, UNRWA, the Civil Registration Authority, and Electronic Health Solutions.

An international CRVS systems consultant and representatives from the MoH and other stakeholders participated in all meetings. The international consultant on CRVS systems, among other areas, reviewed the status of the implementation of the CRVS improvement plan that emanated from the CRVS comprehensive workshop in Jordan conducted in April 2014.[2] Representatives from the WHO country office participated in some meetings. While the team attended most key

[2] The CRVS workshop in April 2014 was preceded by a CRVS rapid self-assessment conducted in December 2012 which showed that Jordan's CRVS system is satisfactory with an overall assessment score of 87%.

discussions together, at times it was necessary to split the team to cover all scheduled meetings.

2.2.3 Key informant interviews

Interviews with key HIS partners focused on issues related to data quality and information use, in accordance with the assessment framework. Discussion typically revolved around the type of systems used, problems related to data collection and flow, limited capacity of staff, use of information for decision-making, and difficulty of assembling information from different sources at all levels. Availability of ICT support and plans for future systems development were also discussed. To facilitate information-gathering and document what emerged from meetings and interviews, the team drafted key questions for each thematic area of the assessment framework and took notes of the discussions. Some departments and directorates made presentations on their work and this information helped the team to compile a list of issues, strengths, opportunities, and major barriers. Using this information, the team cross-checked, compared notes, verified, and discussed impressions. A debriefing meeting was held with senior MoH officials on the last day of the mission to present the observations made in this review and to discuss next steps. The individuals who met with the team are listed in the acknowledgements section.

2.2.4 Field trips

Field trips were made to Prince Hamza Hospital, Al-Hashimi Al-Shamali Comprehensive Medical Centre, and Amman New Refugee Camp in order to assess the current status of the systems being utilized to collect health and health-related data in Jordan.

2.2.5 Synthesis of findings, recommendations, and report preparation

In addition to the documents that were reviewed and the information gathered during the discussion with MoH officials and other stakeholders, the team also used technical judgements and observations and carefully organized the findings according to the thematic areas of the assessment framework. The team used this as a basis to formulate recommendations for improvement. Each team member contributed to each of the sections of the report which were then compiled and organized into a final report and shared with the stakeholders.

3. Findings on health information systems

Improved health information management is an important step to achieve better health outcomes for all Jordanians. Evidence-based decision-making and choices by both service providers (e.g. MoH) and consumers (e.g. the general public) is only possible where a functional HIS exists. A robust, integrated HIS is required to ensure that appropriate information is available at the right time and place and in the right format. The growing need for health-related information by policy-makers, programme managers, donors, nongovernmental organizations, the public at large and other stakeholders demands a unified well-defined system of data collection and reporting from the health facility to national level that will suit all the users of the data.

In Jordan, as in most countries, the HIS serves multiple users and a wide array of purposes. This discussion of the current HIS situation includes: a general overview of the governance structure of the MoH with specific reference to its linkage with HIS activities; description of the systems that provide information related to health; and use of the information they supply, along with the resources required for their successful operation. The strengths and weaknesses of the HIS are summarized following the key components of the assessment framework.

3.1 Institution-based HIS

In Jordan routine HIS and surveillance systems for public health programmes exist across all directorates. The routine health information includes information emanating from the public and private health services at hospital and PHC levels, those resulting from the Notifiable Diseases Surveillance Systems (through mandatory reporting of 44 communicable diseases, cancer cases and

deaths, and cases of chronic renal failure) (Fig. 4). The routine HIS also includes systems which provide information on available human resources, drugs and supplies (pharmacies, pharmaceutical warehouses, and pharmaceutical factories), blood banks, equipment and infrastructure, as well as available financial resources. A population-based cancer registry – one of the best in the Eastern Mediterranean Region – as well as a fully functional and automated CRVS system are two important assets of the national HIS. The non-routine health information includes information emanating from census findings and regular and ad hoc surveys.

The routine HIS is managed through the Directorate of Information and Studies under the Department of Planning Administration (MoH Organogram, Annex 1). Surveillance systems are located within the relevant directorates and supervised by directors of administration. The Director of Planning Administration also supervises the Health Economics Directorate and the Planning Project Management Directorate. The Information and Studies Directorate is responsible for the production of the Annual Statistical Report of the MoH; and the latest published report in October 2016 was that of 2015. Thus, there is timely production of the Annual Statistics Report which is also easily accessible. Aggregated information is collected from hospitals and PHC centres using 30 different paper forms; 20 of these forms are computerized and collected information is entered into electronic forms at the district level. The forms are received monthly and at the end of the year the Annual Statistical Report is compiled (see Annex 2 for contents of the report).

The key function of surveillance systems is to provide public health programmes with regular data for decision-making and essential public health action and response. The Information and Technology Directorate provides support (e.g. equipment, data server and storage, and capacity building) for routine HIS and surveillance programmes.

Data collection, flow, and support

Accurate raw data are the cornerstone of an effective HIS; a good data collection system requires appropriate tools and guidelines. Jordan data collection tools are continuously updated consistent with new information needs. Data collection forms are distributed to different units responsible for data collection such as those focusing on notifiable diseases, noncommunicable

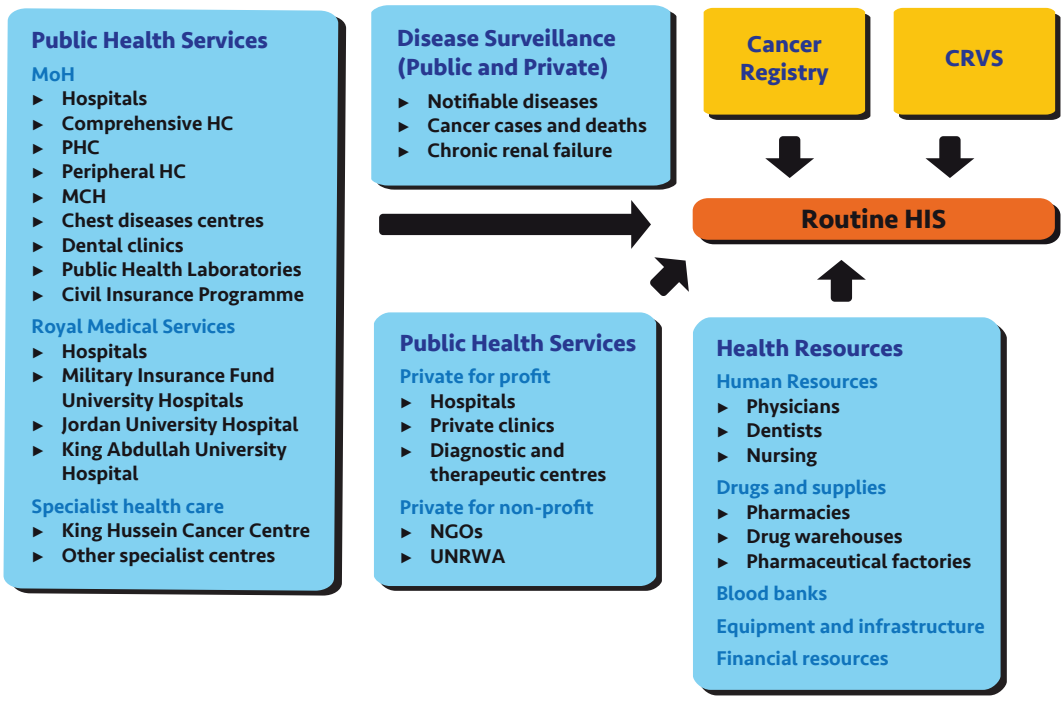


Fig. 4. Schematic representation of routine health information system in Jordan

diseases, mental diseases and service delivery (e.g. antenatal and postnatal care, family planning, child care services, postpartum and post-abortion family planning services). Data collection forms which focus on aggregated disease data do not provide adequate data to understand epidemiological issues and support system response.

In most directorates, data collection for routine health information and surveillance is paper-based. Data are collected in health facilities and transferred to the central level at the MoH either by mail or fax for further data entry and processing. Aggregate data are entered at the health directorate and central level thereby leading to a huge work load for staff and compromising quality assurance mechanisms at the different levels. Nevertheless, a few projects, such as the Health Services Strengthening (HSS) Phase II electronic system, collects and processes data from the peripheral and central health directorates to support operational planning. The HSS II was a five-year (2009–2014) USAID-funded project and its electronic system was developed in 2014 in collaboration with USAID. Recently an Interactive Electronic Reporting System (IERS) – a real time registration system – was developed to collect case-based data. Although the coverage of the data sources in public sectors was not completed, IERS provides real time data and serves a wide range of surveillance programmes (e.g. communicable, noncommunicable, mental health, and service provision data) with flexibility to include other data collection modules.

Human resources

Challenges related to human resources are common among all programmes and directorates. There are limited and qualified people to support all key HIS activities. For example, only one epidemiologist was managing 44 databases for the notifiable disease directorate at the time of the assessment. Further, there are 14 noncommunicable disease focal points that ensure all data are entered yet these focal points manage many other tasks as well. Nurses are also overwhelmed with data entry activities given the existing huge patient care workload. A total of 1783 staff were reportedly trained on data entry of IERS through 52 training courses at the time of the assessment. Regular training for relevant staff in data management, production of reports, and IT support for IERS will enhance the functionality and effectiveness of key HIS activities.

Information and communication technology

The electronic systems for the routine health information and surveillance system are supported by programmers from the Information and Technology Directorate or through outsourcing. The software used for the databases is Oracle which provides separate databases for each of the major systems such as information technology, human resources, finance, professions and health institutions. All databases and main applications are hosted in the MoH data centre which is managed by the Information Technology Directorate. IERS is the only application using SQL programming to manage its relational database systems; and IERS is expected to be handed over to the MoH by 2021. Software and databases licenses are purchased and renewed annually according to MoH needs.

3.1.1 National electronic registration system

Hakeem

The Hakeem program is the result of the first national initiative in Jordan to computerize the public health care sector. The objective of Hakeem, which was launched in October 2009 under the patronage of His Majesty King Abdullah II, is to facilitate efficient, high quality health care in Jordan through nationwide implementation of an electronic health record solution. Using Hakeem, physicians, pharmacists, medical technologists, and other clinicians are able to access electronic medical records of patients within participating health facilities by entering the patient's national ID number. The electronic medical records that can be accessed include comprehensive medical and surgical history, physical examinations, procedural and surgical reports, current medications, and allergies, as well as in-patient and out-patient clinic visit notes. The system also provides online access to laboratory results, digital radiological exams, electrocardiograms, endoscopic biopsies, eye exams, and videos of echocardiograms and angiograms.

Hakeem is built on the VistA system, an enterprise-wide information system used in the United States Department of Veterans Affairs medical system; and is implemented in about 100 facilities. The data server is owned by Prince Hamza Hospital and is different from the MoH server; hence there is no linkage between the two systems. The team observed that the system had no reporting mechanisms and uses ICD-9 coding. The system's equipment and infrastructure related to the program are limited to the needs of implementers and are not allowed to be used for other purposes.

Interactive Electronic Reporting System (IERS)

IERS is an integrated disease surveillance system which uses electronic mobile tablets to monitor the status and functioning of HIS and for monitoring diseases of public health importance among refugees and host communities. IERS is managed by the MoH ensuring the integration between epidemiological and laboratory data and one health approach. IERS data management is cloud-based staged at two levels in order to ensure confidentiality. The system provides real time case-based data using ICD-10 coding and automatically generates short message services (SMS) and email alerts for notification of disease outbreaks and alerts for public health threshold of events that require immediate action. Information on clinical decision and management approach – for example, investigations and medical treatment – is also recorded.

The surveillance reports from IERS are available within one hour. Originally the system was designed to collect data on selected communicable diseases but it has evolved to also collect data on NCDs (heart disease, chronic respiratory disease and diabetes) as well as mental health. Data entry is handled by 14 NCD focal points. At the time of the review, IERS was covering 70% of the MoH facilities, where a total of 550 tablet devices were distributed in 296 health facilities; and planned to cover 600 facilities by the end of 2016. In addition, the system is deployed to cover 100 health facilities of the Royal Medical Services. The system offers opportunities of assessment of treatment outcomes for NCDs because it has built in algorithms for hypertension and diabetes management and control.

3.1.2 Individual, service and resource records

When health services are delivered, basic data are recorded about the client, the conditions observed, and about the services delivered. These individual records form a foundation for providing ongoing integrated care and for assessing the quality of care given to an individual. In Jordan, institution-based data sources of the routine HIS exist in 14 directorates of the MoH, private and university hospitals, MoH vertical surveillance programmes, Royal Medical Services, UNRWA and health professional associations. Data are collected from various streams. For example, primary care data cover areas related to general consultation, dental, general practices, and medical services (laboratory and radiology). Hospital data cover areas related to morbidity, mortality, service delivery, blood bank services, renal dialysis services, births and surgical operation (type and degree). UNRWA and health professional associations provide data on service delivery and human resources, respectively. Production of annual reports requires integration of data from MoH vertical programmes.

The review team observed that surveillance system data sources are undercovered whereas the private sector does not report to the directorates of communicable and noncommunicable diseases, maternal and child health and cancer registry. The private sector and UNRWA health facilities report only to the communicable diseases surveillance system by law for notifiable diseases of epidemic-prone nature and of global/regional concern such as polio.

3.2 Population-based HIS

In Jordan, as in most countries, systems that supply population-based data at regular intervals are owned by ministries other than the MoH. The information from these systems is essential, especially for policy formulation. Getting the needed information in a form that can be easily correlated with MoH's service delivery information requires close collaboration with these ministries.

3.2.1 Census

Jordan's first comprehensive census was conducted in 1961 with subsequent censuses conducted in 1979, 1994, 2004, and 2015. The 2015 Jordan Population and Housing Census was led by the Department of Statistics and supported by the European Union, the Arab Fund for Economic and Social Development, UNICEF and UNFPA. UNICEF support to the Department of Statistics resulted in a disability module included in the 2015 census that provided valuable data on children and adults living with disabilities. The Department of Statistics was able to disseminate results within one month after data collection. Results from the census show that the population of Jordan increased from 6.3 million in 2012 to 9.5 million in 2015. The over 3 million population increase between 2012 and 2015 has been largely attributed to increases in the refugee population.

3.2.2 Surveys

One notable key population-based data source is the Demographic and Health Survey (DHS) which was first conducted in 1990 and by 2016 it had been implemented six times. The latest DHS is the 2012 Jordan Population and Family Health Survey (known as, 2012 DHS) which was carried out by the Department of Statistics in collaboration with the MoH and funded by the Government of Jordan. Additional funding came from USAID, UNFPA and UNICEF. The team was also informed that preparations for the 2017 DHS were ongoing. Other population-based surveys include the NCD and risk factor survey conducted in 2004 and 2007, meaning data for NCD risk factors in the general population are not up to date. A Stepwise survey was planned for 2018.

3.2.3 Birth and death registration data from CRVS

Vital events registration in Jordan is the responsibility of the Civil Registration Authority (CRA) under the Ministry of Interior. The MoH, the Directorate General of Statistics, Higher Population Council and municipalities also play a key role in the CRVS process. For example, municipalities which are in control of cemeteries support the CRVS system by issuing burial permits. In particular, the CRA offices cover the country's 12 governorates and their corresponding districts by its state-of-the-art automated vital events registration system that includes birth, death, marriage, and divorce. The MoH supports the birth and death processes by issuing birth and death notification forms from its health facilities to the families to be used for registration at the civil registration offices. The birth and death registration process is implemented according to national laws and regulations as follows.

Birth registration: If the event takes place at a health facility, the facility issues a birth notification form to the family – and likewise if the event takes place at home the midwife issues a birth notification form to the family – to use for registering the event at the corresponding civil registration office within one month. In both cases no copy of the birth notification form is sent directly to the CRA from the health facility/midwife for verification.

Death registration: If the event takes place at a health facility, the facility issues the family a death notification form to use to obtain the burial permit from the municipality office and to register the event at the corresponding civil registration office within one week. If the event takes place at home the family should take the body to a health facility to get the death notification form to use to obtain the burial permit from municipality office and to register the event at the corresponding civil registration office within one week. As with birth registration, in both cases no copy of the death notification form is sent directly to the CRA from the health facility for verification.

Reporting of mortality statistics in Jordan started in 1959 until 1979, with a break from 1980 to 1999 after the responsibility of data collection was transferred to the Vital Registration Department, which was established in 1977. During the period 1980–1999 there was no reporting on mortality data and the data collection tool did not meet international standards.

In Jordan, reporting on cause-specific mortality data is under the NCD directorate. The available data from 2003, 2004, and 2008 to 2011 use 4 digit codes of ICD-10. Death registration or notification is estimated at 70%: this leads to an underestimate of the crude death rate.[3] The average garbage code[4] is 10%, while the low range of completeness which represents 63% of cases affects data usability. The death certificate contains a medical section for reporting underlying causes of death which includes about half of the minimum medical and registration variables. An electronic system was established in 2003 with medical staff trained to complete the medical section of death certificates, and a copy is sent to the MoH central level for data coding and management. All deaths are notified through hospitals whose medical staffs are responsible for writing death notification. Jordanian national ID is used to facilitate linkage between civil registration data.

Birth registration coverage is almost universal (95%) and the 2012 DHS reported that 99% of births take place in health facilities. Currently, the maternal and under-5 mortality registry has been introduced within the mortality reporting system at the national level and the programme is reporting to the NCD directorate.

3.2.4 National Cancer Registry

The National Cancer Registry (NCR) is located under the Primary Health Care Administration directorate of the MoH. It is a population-based registry covering cancer cases among both Jordanians and non-Jordanians. The NCR strives to implement the best possible international standards in cancer registration and surveillance. It functions based on both active and, more predominantly, passive surveillance. Benign and borderline cases are not registered. Data collection makes use of the Middle East Cancer Consortium and International Agency for Research on Cancer standardized instrument, which includes: patient's data, tumour data, treatment data and sources of data. However, treatment data are collected superficially at NCR and no prognosis and recurrence or remission is reported. Follow-up on patient status (predominantly concerning mortality) is cross-checked with the Civil Service Bureau, which informs on the patient's status. In the case where the patient has more than one primary tumour, the patient is counted twice, with each tumour considered as one independent case.

The NCR takes between 6 to 18 months to register a new cancer case following cancer diagnosis. Data are coded using the International Classification of Diseases for Oncology (ICD-O-3) and forwarded to the central office in NCR. Data are processed, doubled-checked for correct coding and entered using CanReg software, version 5. In addition, Jordan arranged for an imPACT review mission in 2012; imPACT is a service offered by the International Atomic Energy Agency (IAEA) to its Member States through the IAEA's Programme of Action for Cancer Therapy (PACT). The imPACT review mission resulted in concrete recommendations for improving cancer registration in Jordan.

The total number of full-time staff in NCR was seven: four physicians, two data collectors and data entry clerks, and one secretary. In addition, 50 focal points were distributed throughout Jordan. Data archiving is based on: One patient One file. All data on cancer for Jordan between 1996 and 2010 have been archived. However, data post-2010 were not being archived. Data quality control is conducted from data collection and coding to filtering and entry. It is done both manually and visually, as well by using computer applications. Before and during data entry, validation of data is conducted by: assessing data completeness through continuous generation of lists of patients who do not have a diagnosis or those not classified as cancer or non-cancer; and checking essential demographic data such as age, date of birth, sex, and address. Patient lists are also evaluated for duplicates. Internal quality checks are also conducted and include random selection of some records for double-checks of data abstraction and to ensure completeness. In the case of incomplete, incorrect,

[3] The number of deaths per 1000 population in a population in a given year.

[4] Used to calculate the valid target cause of death.

or inconsistent data, NCR connects directly with the reporting facility.

The first national cancer report by NCR was published in 1996 and the last one was published in 2012. A fact sheet was prepared for 2013. At the time of the review, the 2013–2014 cancer report was being prepared. All the reports are available online on the MoH website and NCR is also planning to launch its own website.

3.3 Key observations of the HIS in relation to the assessment framework

A number of observations were made related to HIS in Jordan. The main strengths of the HIS includes the existence of a functional Directorate of Information and Studies under the Department of Planning and Administration that coordinates HIS activities. The team also observed growing demand for health-related information from senior programme managers, policy-makers, donors, NGOs and other key players in the health sector for health-related SDGs. Jordan's HIS has a well-defined system of data collection and reporting from the facility level up to the national level. Most units report information frequently and timely. There are well-defined catchment areas and administrative boundaries. Information from census and surveys conducted by the Department of Statistics and other partners is regularly used. The National Health Strategy (2015–2019) provides an agenda that makes strengthening of HIS inevitable. The strong Notifiable Disease Surveillance System and population-based cancer registry are some of the key attributes of Jordan's HIS. The fully automated vital registration system is one of the key data sources. Nevertheless, the HIS in Jordan has a number of weaknesses that are discussed in the next sections following the components of the HMN Framework.

3.3.1 Governance

Strengthening HIS requires strong and persistent institutional will demonstrated through governance guidelines – to identify key stakeholders and interactions between various actors, and to specify the protocols for technical and data architecture innovations to improve collection, management, interoperability, and dissemination. During the review, the team observed that Jordan has a national identity system for its citizens and, more important, there are existing information systems across all directorates and many larger provider units.

Although the Directorate of Information and Studies is responsible for collection of health information and production, in terms of HIS governance there is no HIS national steering committee with the overall responsibility to coordinate national health statistics initiatives. The team also observed the lack of integration and communication between the Health Information and Studies directorate and other directorates. This affects the completeness and knowledge of the available data and indicators that are used to produce the annual statistical yearbook. Further, the team also observed: lack of integration between facility-based and other programme information systems; lack of coordination between the MoH and some key stakeholders; staff turnover and huge workload; and different provider organizations (including NGOs) with varying capabilities in health information. The existence of uncoordinated efforts is detrimental to effective implementation of HIS.

While the MoH has a strategic plan for the period 2013–2017 which identifies a major need to improve information systems and data for decision-making and to set policies based on sound scientific review, there are no HIS short- and long-term strategic plans that include clear priorities for action and responsibilities. The team also observed that despite national efforts to conduct large population-based surveys such as the DHS, there is no national strategic plan for surveys to guide coordination and implementation of surveys within the limits of the available resources. While coordination and effective HIS management are essential for effective service delivery at the national level, the team observed limited streamlining of programme area activities with relevant technical directorates.

Several indicators are produced from the HIS and this can be strengthened by instituting a well-defined national core indicator list and datasets

especially those related to equity, performance, and cost of interventions.

3.3.2 Infrastructure and support

The MoH has the basic infrastructure to collect, transfer, and consolidate data from public health facilities, university hospitals, and Royal Medical Services for its morbidity and mortality registries. The MoH also produces the core health indicators centrally through the directorates of Communicable Diseases, NCDs, Information and Studies, and Information Technology. The MoH is automating the processes in its health facilities via two major innovative systems: IERS and Hakeem (a Hospital Management Information System). These two systems should bring major improvements in data collection quality, timeliness of transfer to morbidity and mortality registries at the MoH, and analysis and production of health indicators. The Civil Registration Authority has an automated vital events registration system that includes birth, death, marriage, and divorce. The system covers all 14 governorates and their corresponding districts for online data registration, collection and verification against its identification system. The three systems are discussed below.

Interactive Electronic Reporting System (IERS)

IERS is cost effective in terms of national scale-up as well as maintenance. It provides individual-level as well as population-level outcomes and can generate data on clinic-based performance as well as quality of care indicators, with opportunities for conducting cohort analysis. The system has the capability to collect access and care data on the refugees residing in Jordan.

However, the team observed that IERS can improve its effectiveness if all the vertical surveillance programmes forms and reports are coded into the system to facilitate collection and reporting of cases to the MoH integrated registries database. The IERS database also needs to be expanded to cover all of the four related NCD risk factors and to be linked with the National Cancer Registry. The planned nationwide scale-up is ideal and should ensure that facilities are equipped with sufficient tablets. For example, the team found that only one tablet was available at the PHC units and two tablets at the comprehensive health facilities. Network connectivity challenges in some facilities also compromise timely data collection and onward transmission. Another observation was that IERS has not integrated the WHO and International Society of Hypertension cardiovascular risk prediction charts algorithms to enable calculation of cardiovascular disease risk. IERS also lacks a built-in WHO death certificate to ensure that all morbidity data are recorded using ICD-10 and to ensure comprehensive coverage to include all MoH facilities, UNRWA, military health facilities, as well as private and NGO facilities.

Data completeness is extremely variable, ranging from about 25% to 75%, especially for NCDs. There is also lack of triangulation with MoH paper-based records, Hakeem, CRVS, household surveys, as well as other related health facility data.

Hakeem

Hakeem offers the benefits of computerized public health care in Jordan by facilitating easy access to electronic health records. Through system upgrades, Hakeem has the potential to provide additional features such as: unified web application for both dashboards and reports; automatic data update; high reporting capabilities for generating analytics and charts; multi-browser web application; and responsive design to cover all user needs.

For Hakeem to serve the reporting needs of the MoH, the Information and Studies and Information Technology Directorates, in collaboration with the Communicable Diseases, NCDs, and Quality Directorates, should provide Electronic Health Solutions who manage Hakeem, with the required set of disease surveillance reports, structures and formats compatible with those generated from the IERS system and according to expected data quality standards. This will ensure that Hakeem and the MoH central systems are interoperable. When interoperability is established, reports can be generated by Hakeem and reported online to the MoH central registries databases.

Civil registration and vital statistics system

The automated civil registration system enables the CRA to collect vital registration data and produce its vital statistics annual report with indicators disaggregated by sex, age of mother (for births), age at death, date of events, and country of birth/death at the national, subnational and district levels, for Jordanians and non-Jordanians. The annual vital statistics report is produced on time, distributed to all relevant stakeholders, and is available on the CRA website. Nevertheless, the team observed that the system lacks a verification mechanism between the registered events and the events taking place in health facilities. This verification mechanism needs a direct link with the MoH to receive copies of birth/death notifications.

The national cancer registry

The cancer registry has adequate, complete as well as comparable data of national coverage for both Jordanians and non-Jordanians. Based on the registry data, Jordan can estimate cancer incidence with a high degree of precision. The quality and validity of the data is adequate given the ability of the registry to follow up on mortality status and the low amount of missing data. However, the team identified potential areas for improvement. The quality of the data can be enhanced if the registry is expanded to collect additional information on prognosis and disease recurrence. The registration time between diagnosis and data entry is long and no linkage exists with Interactive Electronic Reporting System (IERS) and Hakeem. Senior MoH staff in charge of the cancer registry requested WHO to support training on International Association of Cancer Registries tools and CanReg software (version 5).

In addition to the functionality of the systems, the team observed that capacity-building activities for staff are conducted vertically per programme based on the programme-specific budget. Using a common platform to report surveillance data from different programmes from the terminal facilities to the MoH registries may reduce human resource needs and minimize capacity-building needs by incorporating it as part of the HMIS regular training programmes. The HIS can be effective if capacity-building of human resources is conducted centrally through regular and periodic training on production, analysis, and integration of health indicators.

3.3.3 Data management and standards

Data management includes all aspects of data handling from collection, storage, quality assurance and flow, to processing, compilation and analysis. Timeliness is one of the critical aspects of data management, especially for surveillance systems.

In Jordan, routine aggregate data are collected using paper forms; paper forms were the dominant format until 2014 when electronic reporting systems were developed. Data entry is typically done at the central level except for some public health programmes that are supported by IERS. Surveillance systems for communicable and noncommunicable diseases use clear definitions of data elements, standardized case definition, and updated notifiable diseases data collection forms following WHO standards. Reproductive health information and the family planning reporting system implements data quality checks through supervisory visits.

Despite efforts to improve data management, the paper-based format of data processing is prone to technical errors and loss of valuable data. In particular, the team was informed about weaknesses emanating from the paper-based system such as delayed reporting, incompleteness and data inaccuracy. These challenges often lead to inefficient data dissemination and information products that are of low quality. In addition to inconsistent data, there is a lack of regular feedback from the routine quality assurance mechanisms to data collectors and users.

3.3.4 Quality assurance

A well-functioning HIS relies on a set of standards or guidelines for quality assurance procedures. Establishing standards is a key governance function. The absence of quality assurance standards creates room for data contamination, unreliable indicators, and compromises evidence-based decision-making. Thus, a balance between investments in

data collection, processing, and quality assurance procedures should be the ideal standard for any HIS.

While some departments are able to implement some quality assurance procedures, these are not implemented to full scale across the entire MoH. For example, release of key outputs such as the *Annual Statistics Report* is often delayed due to low accuracy and completeness of the information received. Discrepancies between the original copies of data and the final published data are some of the challenges reported by the MoH. In some departments, data plausibility checks are conducted but there is limited data authentication and validation systems, including lack of an official report on quality assessment. The annual report on cause of death is normally delayed and of low quality. This is influenced by delays in the transfer of the forms from health facilities to the central level, manual data entry of hand-written forms, as well as shortages in human resources for data entry, coding and analysis of data. Data quality and plausibility checks for cause-of-death data are also limited.

Where existing, with sufficient human resources quality assurance procedures can be effectively implemented. The availability of human resources has an enormous effect on the capacity to deliver data of high quality. The existence of vertical programmes each with different reporting requirements and systems affects integration of data and compromises quality.

3.3.5 Dissemination and data use

Standards are needed to assess whether the statistics available to decision-makers are comprehensive, timely, accessible and reliable. The MoH disseminates data through its website, the *Annual Statistical Report* and maternal and child health periodic reports. Key health indicators and statistics on maternal and child health, and use of MCH services to monitor progress of public health targets, are shared with the public and senior officials for decision-making. Despite the abundance of information at the health services level as well as the availability of published data in the *Annual Statistical Report*, there is a clear inadequacy when it comes to processing and analysis of data and, consequently, the production of indicators and important health information. The information system should have the capacity not only to collect and store data but also to manage, process, analyse, report and disseminate reliable data on key health indicators on a regular and timely basis. Standards of operations are equally required and need to be developed in order to ensure that all information offices (whether at central or district levels and at the different MoH health facilities) have information transmission facilities through internet connections or other ICT-based methods.

Information does not only need to be available, but it should be the right information, in the right place and at the right time. The existence of the quantity of information that is largely manually processed and the human resource constraints facing the Directorate of Information and Studies reflect enormously on the quality and layout of the *Annual Statistical Report*. Not all data are fully entered or adequately cross-validated during the report preparation. Interviews with key informants showed limited evidence that the information collected is used to provide and manage good health services. The diverse public and private health delivery system results in the Directorate of Information and Studies struggling to ensure timely production of complete and reliable information for improved targeting of health services. Further, local level health information decision-making remains weak.

A cancer registry report is also published by the Department of Primary Health Care Administration. The latest report published in October 2016 provides data from 2013, which indicates delayed reporting and dissemination of cancer information. The report, however, is of high quality and cancer cases are reported by hospital, districts and governorates using ICD-O-3 codes.

A review of the country reporting status on core indicators showed that some regional core indicators were not reported for some years. Discussions with MoH officials showed that most of the data to calculate the missing indicators are available. One of the challenges discussed during the review is the lack of capacity to calculate the indicators, as well as capacity to report and provide

interpretations for selected indicators. During the field visits the team also observed limited production of reports and use at peripheral level within facilities using different IT programmes such as Hakeem and the specific electronic programme of UNRWA. Ideally information transmission, dissemination, and use should commence from the point of data collection upwards, in order to make sure that reporting as well as any needed corrections are performed in a timely manner.

Although IERS is allowing data to be available and used at all levels of the health system, including automated generation of reports, there is a need for information transmission, use and dissemination to be strengthened across the entire HIS. Restructuring the current system at the different points, starting from the primary care levels and upwards to include all MoH facilities, will enable timely identification of disease outbreaks, stock-outs and service delivery gaps, and enable corrective measures. At the same time, it will allow data accessibility to all health care providers within the same health facility in order to improve service delivery. In addition, providing better health care and disease information will improve patient management and the promotion of healthier lifestyles.

The availability of other forms of information products, such as dashboards and queries, as well as development of alerts and SMS within the IERS is remarkable. However, these information products should be developed for the entire integrated HIS. Ensuring easy access to information for decision-makers is a core function of HIS in demonstrating the value of the data it contains.

4. Recommendations

In general, the recommendations provided here are aimed at streamlining and strengthening both current and new systems, processes, and entities across the entire HIS. These recommendations can be realized through a well-coordinated approach by the MoH, its Information and Studies Directorate, and all key stakeholders. Such coordination will contribute to an effective HIS with increased access, data quality, and optimal efficiency.

For some recommendations, illustrative activities are provided as examples that may be necessary to achieve a particular recommendation. These examples are not exhaustive and can be further fine-tuned or operationalized through technical coordination.

4.1 Governance

Recommendations and suggested activities in this thematic area are aimed at improving management, coordination, and efficiency for all HIS stakeholders. Achieving this can be done by carrying out recommended interventions to strengthen and support management capacities at all levels. This will lead to, among other results, better coordination and impact, and enhancing transparency, resource management and utilization, accountability and supportive supervision.

- The HIS can be strengthened and respond to national development needs by ensuring that the role of the MoH is clear as the leading entity for HIS and coordinator for HIS-related activities in collaboration with relevant stakeholders. The Information Technology and the Information and Studies directorates are critical directorates which require strengthening and empowerment in setting standards and expectations for enhancing HIS. This can be done through a functional national steering committee in charge of HIS coordination. The committee should involve all relevant stakeholders on HIS and respond to strategic issues related to HIS. In consultation with the Higher Health Council and relevant departments from public and private health sectors, the committee should define the minimum set of core and essential national health indicators and data sets necessary to support the implementation of the National Health Strategy (2015–2019).

- The HIS national steering committee should also be responsible for approving and commissioning additional health data collection activities to avoid duplication of efforts and ensure added value.

- Data collection tools need to be reviewed and updated in line with new information needs, and ICT needs to be integrated into the business process of the health delivery system.

- The profile of the Information and Studies Directorate as a key custodian and lead actor in HIS should be raised through advocacy, awareness, and allocation of optimal resources for its functionality.

- The Information Technology and Information Studies directorates should be strengthened and supported in setting standards for data collection, processing, dissemination and use.

- Unified HIS short- and long-term strategic plans should be developed that include clear priorities for action and responsibilities to guide implementation of activities. The strategic plan should address all major data sources described in the HMN Framework (censuses, civil registration, population-based surveys, individual records, service records and resource records) and its implementation at the national level.

- Programme area activities should be streamlined with relevant technical directorates.

- A national surveys strategic plan can be developed that aims at coordinating with other stakeholders and setting priorities for household surveys.

- Maternal mortality surveillance systems should be improved and coordination ensured with the Maternal and Child Health Directorate to strengthen the response plan to reduce maternal and neonatal deaths.

4.2 Infrastructure and support

Infrastructure and support is a critical component of HIS functionality. Recommendations are aimed at creating an opportunity to help to reduce the HIS workload burden of staff at all levels and ensure that all relevant systems are interoperable.

The recommended interventions include the following.

- The HIS functionality and effectiveness should be enhanced based on MoH needs and WHO standards. This can be achieved by ensuring that all disease surveillance forms and reports, including the death notification form, are coded into IERS in order to standardize and speed up the data collection and reporting.

- The Information Technology and Information and Studies directorates in collaboration with the directorates of Communicable, NCDs, and Quality should provide Electronic Health Solutions with the required set of disease surveillance reports, their structures and formats compatible with those generated from IERS to ensure that the systems are interoperable.

- The MoH should strengthen and support the IT Directorate to provide the state-of-the-art ICT infrastructure for an effective HIS. This should be accompanied by regular review of existing guidelines that define the business process of the MoH, the appropriate technologies within those processes and new technologies to collect and analyse data in real time, thereby facilitating rapid decision-making and deployment of support and response activities.

- Inadequate human resources – a common problem across the entire MoH – to implement quality assurance procedures has led to delays in releasing information to the MoH, thereby affecting timely release of annual reports. A human resource structure for the health information department from the health facility to the headquarters should be developed. The structure should outline the number of staff required at each level, including their qualifications, experience and career path. This will help to define minimum staff requirements for the optimal functioning of the HIS and act as an advocacy tool in seeking increased budget allocations.

- Regular and periodic training programmes should be implemented for human resources both at terminal facilities and central level for collection of case data, analysis and production of core indicators.

- The gap with the CRA should be closed by sending copies of birth and death notifications to it online. This should improve birth and death registration coverage.

- Monitoring and evaluation of institution and population-based data sources should be strengthened.

- The capacity of IERS should be improved to produce the WHO/International Society of Hypertension risk prediction charts.

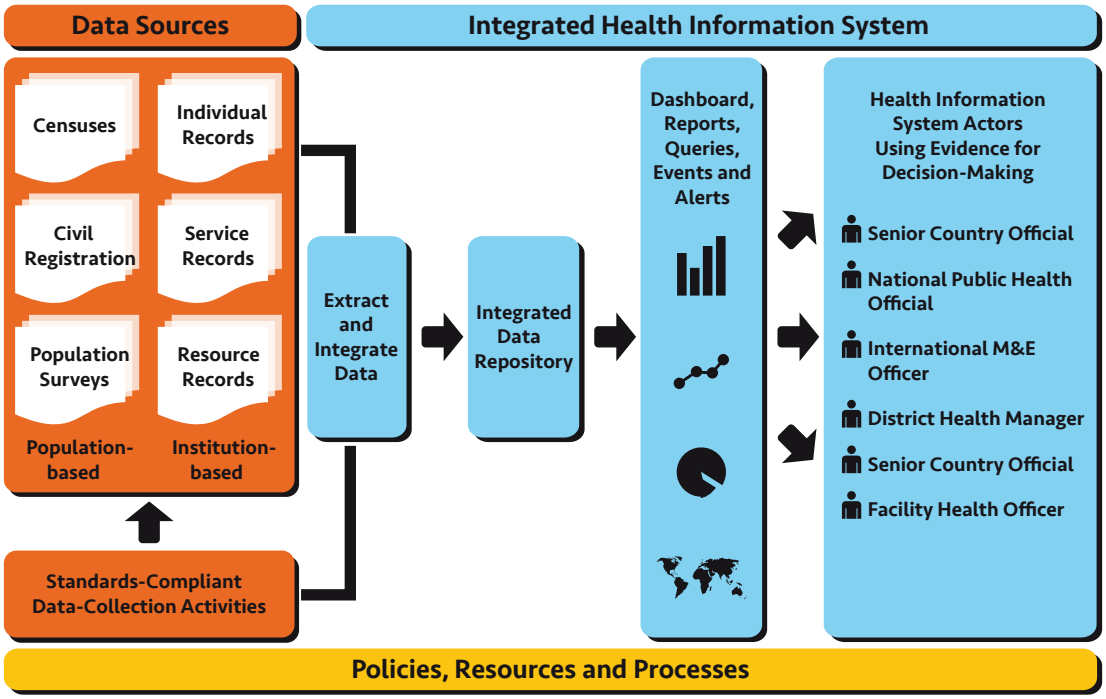
4.3 Data management and standards

Data management and standards are building blocks for any HIS and need to be valued and adhered to by all parties to the HIS. This section provides some key recommendations that are inevitable for an HIS that is required to share information or integrate with any other application that is part of the same system (see Fig. 5).

- Capacity-building should be strengthened in epidemiology training, data management skills and IT skills and incentives offered to retain high skilled staff.

- A data repository should be developed for the entire HIS to enable data extraction, linkage, triangulation with other sources such as population-based data (e.g. census) and institution-based data (e.g. service records) and compiled into usable statistics and information for deeper analysis and comparison of various heath indicators. Thus, information from non-routine sources and routine sources would provide data into the repository. While IERS is acting as a data repository to collect data from other sources (e.g. UNHCR, refugee camps, and Hakeem), developing or transforming it into a data repository for the entire HIS (i.e. to include data from other sources) is inevitable.

- Guidelines and standardized operational procedures should be developed for data



Source: HMN Framework (second edition, 2008)

Fig. 5. HMN model of health information system integration

management (data collection, storage, analysis, reporting, dissemination and utilization). In addition, national health indicators metadata and agreed data sources should be developed to guide data collection, processing, and analysis.

- The use of ICD-10 should be enforced across all health facilities and relevant data collection systems (e.g. Hakeem) to report morbidity and mortality. This should be accompanied by training of relevant staff on ICD-10 to enhance common understanding of the disease and mortality burden.

- The capacity of the Hakeem system can be improved to automatically generate statistical/analytical reports and also provide data on NCDs (heart disease, chronic respiratory disease and diabetes). In addition, the cancer-related morbidity data from Hakeem should be linked with the National Cancer Registry (NCR) in order to serve as an active surveillance method for the NCR and improve completeness.

- International standards should be followed for data and statistics quality such as the United Nations Principles and Recommendations for a Vital Statistics Systems[5] to strengthen the CRVS system and its information products.

- IERS should offer complete national coverage as a surveillance tool as well as a tool for collection of causes of death from health facilities.

- Possibilities should be explored to integrate IERS with facilities covered by Hakeem.

- The data entry for IERS should be revisited to make it more efficient and less time consuming. This can also be achieved by training staff other than the nurse who can enter follow-up data on patients.

4.4 Quality assurance

Due to the inadequate data quality mechanisms that were observed by the team and their role in undermining the usability of the data to maximum potential, recommendations in this area are provided to ensure that data are collected and processed with the highest degree of consistency and accuracy.

- A clear mandate should be established across all the systems in terms of minimum standards for data quality assurance systems. These can be achieved through strategies such as: 1) adopting simple error-trapping tools such as comparing tally sheets to registers; 2) minimum expectation for data entry double-checking procedures; and 3) instituting automated e-validation and derivation tools to ensure reliable data quality.

- Processes for achieving the quality assurance standards identified above should be clear, and the responsible unit within the MoH to support the quality assurance process should be clearly identified. For example, the team collecting and processing data should know who is in charge or who can query or check the data to make sure they are correct. Data authentication and validation systems can be achieved by ensuring that:

  - The head of the health facility is responsible for the accuracy, completeness and timeliness of data at the collection point before onward transmission to the next level.

  - At the district level, the District Health Information Officer conducts quality checks before the data is submitted to the District Medical Officer for utilization and onward transmission to the province.

  - At the provincial level, the Provincial Health Information Officer checks on the quality of data before submitting to the Provincial Medical Director for utilization and onward transmission to the governorate.

  - At the governorate level, the Governorate Health Information Officer checks the quality of data before submitting to the Governorate

[5] http://unstats.un.org/unsd/demographic-social/Standards-and-Methods/files/Principles-and-Recommendations/GRVS/M19Rev3-E.pdf

Medical Director for utilization and onward transmission to the head office.

- Supportive supervision mechanisms and refresher training are important and should be tailored to managing information systems and their staff. Experience with supportive supervision for the National Cancer Registry should be a model to follow.

- To avoid data discrepancies, definitions and methodologies should be standardized when the same data elements or indicators are used, collected or derived across different systems and programmes.

- A wide range of policies and processes are needed to ensure data quality. One guiding principle is to reduce the necessary amount of information to a "minimum dataset". This will then reduce the burden of data collection and improve data quality.

- Capacity-building should be conducted on the Analysis of Cause of Death (ANACoD) tool to improve quality of mortality data and essential basic quality checks.

- Refresher training for responsible staff should be conducted on the International Association of Cancer Registries (IACR) tools and IACR CanReg5, the open source tool to input, store, check, and analyse cancer registry data. The training should focus on quality assurance mechanisms.

- IERS data collection should be expanded on risk factors (physical activity and diet). The expansion should include collection of data on NCDs to include specific information on cardiovascular risk disease.

- A long-term training plan should be developed on appropriate writing of death certificates particularly for new graduates and undergraduates. This can be done through introduction of the ICD-10 within the undergraduate curriculum.

- The availability of adequately trained health information personnel with capacity to develop, review, adapt, implement, monitor and evaluate at each level of health information management should be ensured. The job descriptions of health information officers should be reviewed and upgraded in line with their responsibility and experience.

4.5 Dissemination and data use

Health information systems should be prepared to produce high quality data that lead to useful health information and knowledge products that support evidence-based planning, policy formulation, decision-making, and action. This can be achieved if reliable information is available, in a timely manner, and in the right format. In order to improve health outcomes in Jordan, the HIS remains a core mechanism to access crucial information and knowledge. Nevertheless, the review team found a number of areas requiring strengthening strategies for data dissemination and use.

- National health information standard operating procedures or guidelines should be developed for dissemination of health data across and within users and producers. That is, health facilities, MoH, other concerned government bodies and the public. These standards should focus on the four dimensions: data characteristics, quality, access, and integrity.

- Dashboards and other strategies should be developed to increase access to health data and information by policy and decision-makers through improvement in data storage, retrieval, analysis and presentation. While IERS produces dashboards for communicable diseases, noncommunicable diseases and mental health, there is a need for comprehensive and integrated HIS dashboards with information collected from population-based data sources (census, civil registration, population-based surveys) and institution-based data sources (individual records, service records and resource records).

- Data from population census and population-based surveys should be disaggregated and

disseminated to the district level for monitoring service coverage and performance.

- Annual statistical reports should be published with all data checked for completeness and accuracy, as well as reporting on health indicators that monitor progress of public health targets. To improve the data being disseminated in the annual report, the MoH should be producing annual health profiles (with trends over time) that could consist of the 68 WHO regional core indicators and health-related SDGs.

- Local-level health information decision-making should be strengthened. If efforts are required by those that have to contribute to data-gathering to higher strategic levels without clear benefit to their own operational (let alone clinical) level, these contributions may not be made willingly or reliably, but rather seen as an excessive burden not impacting on the quality of their own efforts.

- Enhance the current MoH website to increase access and dissemination of health information by ensuring that data are available in formats that are easy to access, interpret, and use at different levels of the health system and at the community level. This can best be achieved by enhancing skills of staff in data analysis, presentation, and use.

5. Next steps

The HIS improvement agenda requires comprehensive plans and a schedule that detail the systems to be developed/strengthened/reformed/used as is, as well as the output to be expected, the costs, responsible parties, and any other areas recommended for strengthening. Developing this HIS improvement plan requires coordination among all stakeholders and guidance by a strategic plan that takes into account the strengths and opportunities of the current HIS.

The improvement plans should be based on the observations discussed in Section 3 regarding findings on health information systems, and focus on integration, institutional collaboration and technical implementation in areas related to: governance; infrastructure and support; data management and standards; quality assurance; and dissemination and data use (discussed in Section 4). The efforts and investments to improve HIS can be coordinated in the context of the overarching 2025 National Vision and Strategy, the National Health Strategy (2015–2019), and the MoH strategy (2013–2017). The Higher Health Council and MoH, guided by the National Health Strategy, should mobilize support for consensus-building in defining the primary goals and interventions to improve HIS.

The recommendations presented in this report can be used to develop short-term, medium-term and long-term plans for HIS strengthening. The process of strengthening the HIS so that it can support implementation of interventions and monitor their effects can take at least 4–5 years. This can be developed through involvement of stakeholders and HIS specialists. However, there are some tasks or interventions that can be deployed in the short term to guide development of the improvement plan and also strengthen existing HIS operations without much change. These interventions, their estimated person-days and proposed timeframe, which are consistent with the recommendations in Section 4 are provided in Table 1. The proposed timeframe can be adjusted based on the actual time period for commencement or implementation of the HIS improvement plan.

In addition to the interventions presented in Table 1, there is a need to ensure that recommendations from the CRVS rapid and comprehensive assessments (which hadn't been implemented at the time of the review) are addressed as part of efforts to improve HIS. This is very important considering that the MoH is a key stakeholder within the CRVS system. These and other recommendations[6] are presented in Table 2.

The improvement plan could be guided by the schematic overview of strengthening HIS to its fullest potential in the entire country. Fig. 6 illustrates the model for strengthening HIS in

[6] Full details of these recommendations are contained in the CRVS rapid and comprehensive assessments reports.

Table 1. Selected interventions to strengthen the HIS and their estimated person-days

Selected intervention to strengthen the HIS in the short term	Estimated person-days		
	International expert	Local expert	Proposed time frame
Governance			
Develop HIS policy and policy guidelines to ensure availability of quality data and their optimal use	10	45	By end of Q3 2017
Infrastructure and support			
Construct a matrix of comprehensive health indicators needed for monitoring and evaluation of health sector programmes at all levels	7	30	By end of Q4 2017
Develop guidelines for integrating health data from all sources and disseminating to all concerned stakeholder through a single repository (see Fig. 4 and Fig. 5).	10*	30**	By end of Q1 2018
Develop a costed HIS strategic plan for the period of the next long term health sector program	10	30	By end of Q1 2018
Data management and standards			
Develop a comprehensive data management guideline based on approved health indicators, existing data collection systems, and new policy directives	15	30	By end of Q1 2018
Quality assurance			
Develop a generic routine and periodic data quality audit tools and guidelines for self-administration by individual data collection system as well as for external comprehensive data audit	5	20	By end of Q1 2018
Data dissemination and use			
Develop data dissemination templates and guidelines for use by health facilities, governorate, and relevant directorate at MoH.	5	20	By end of Q1 2018

Notes: *Developing ToR and reviewing the process and product. **This would involve an IT expert.

Jordan, building on the existing MoH strategy, formulating a national steering committee led by the MoH which would lead to the development of an MoH HIS strategy, defining national core indicators, and developing a human resources plan. Successful development of these strategies will guide improvements in infrastructure, data collection systems and tools, and a national data repository that provides data for evidence-based decision-making. Periodic HIS assessments and reviews will lead to a functional and sustainable HIS in Jordan. The timelines from the first step in Fig. 6 (MoH strategy) to the last step (periodic assessments and reviews) can be agreed upon by stakeholders during meetings or workshops to develop action plans to improve HIS.

5.1 Detailed proposed steps to improve HIS

These are proposed steps to ensure accurate, complete, timely and readily available data to health care providers, health managers, planners and policy-makers in Jordan at all levels. These steps should complement the information illustrated in Fig. 6.

1. HIS national steering committee should define the minimum set of national indicators and data sets necessary to support the implementation of the National Health Strategy (2015–2019) (core and essential health indicators), in consultation

Table 2. Interventions to improve CRVS in Jordan

Intervention	Proposed timeline
Establish a high level multisectoral CRVS technical steering and coordination committee composed of relevant sectors. This may be achieved with the involvement of the MoH under the auspices of the Higher Health Council	By end of Q3 2017
Ensure direct paper or electronic notification from the health sector to the Civil Registration Authority (CRA) to improve death registration or issue burial permits from the CRA after the event is registered, instead of being issued from municipalities (based on the death notification form)	By end of Q3 2017
The MoH should take initiatives to promote the need for an ICD-10 compliant death certification curriculum to be taught within undergraduate medical education. This can be done through the Higher Health Council.	By end of Q4 2017
Implement an electronic death notification form via an automated and secure web-based online system.	By end of Q1 2018
Establish a direct electronic link from the CRA to the General Directorate of Statistics and MoH for timely information sharing under the e-government framework. This needs coordination among the three key stakeholders and other ministries such as the Ministry of Communication and Information Technology. This may be one of the tasks of the coordination and steering committee if established.	By end of Q1 2018
Mobilize funding to support establishment of a set of mobile registration units that move to remote areas to provide access to registration.	By end of Q1 2018

with relevant departments from all relevant public and private health sectors.

2. Data collection tools need to be developed/ updated in line with new information needs and ICT needs to be integrated into the business process of the health delivery system.

3. A human resource structure for the Information and Health Studies Department from the health facility level to the headquarters level should be developed outlining the number of staff required at each level, including their qualifications, experience, and career path.

4. At health facilities, health workers using appropriate HIS software will record all patient-based information statistics in line with the list of core health indicators using various electronic data collection forms. Data will be automatically aggregated further into monthly summaries which will be available for use at the district, governorate and national level.

5. Standards are critical to enable information to be shared effectively and efficiently between all users and consumers of health services. Therefore, standard operating procedures for data management (data collection, storage, analysis, reporting, dissemination and utilization) should be developed.

6. An integrated approach should be put in place to bring together the routine data, human resources, logistics, laboratories, administration and transport management information systems to be accessed in one central repository of data.

7. A data authentication and validation system should be introduced to enhance data quality and use at the level at which data is first generated in the service, in order to increase confidence in the completeness and reliability of the data at higher levels in the health system.

8. Data resulting from population census and social-demographic surveys will be disaggregated and disseminated to the district level for their use in monitoring service coverage and performance.

9. Compiled data and indicators will be used for measuring the performance of the health service delivery system and for monitoring progress in the achievement of subnational, national and international health goals.

10. The HIS national steering committee will be responsible for approving and commission additional health data collection activities to avoid duplication of efforts and ensure added value.

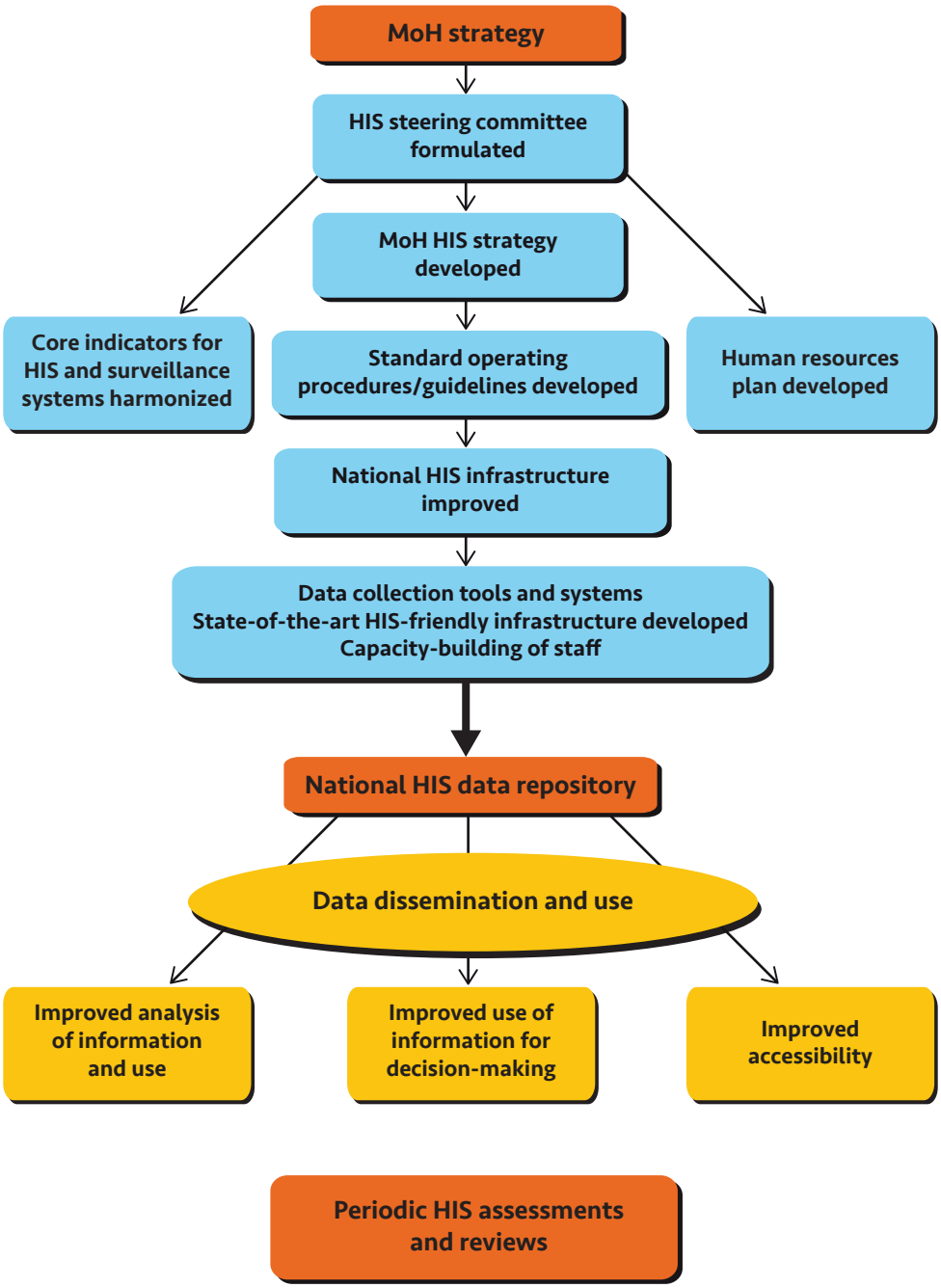
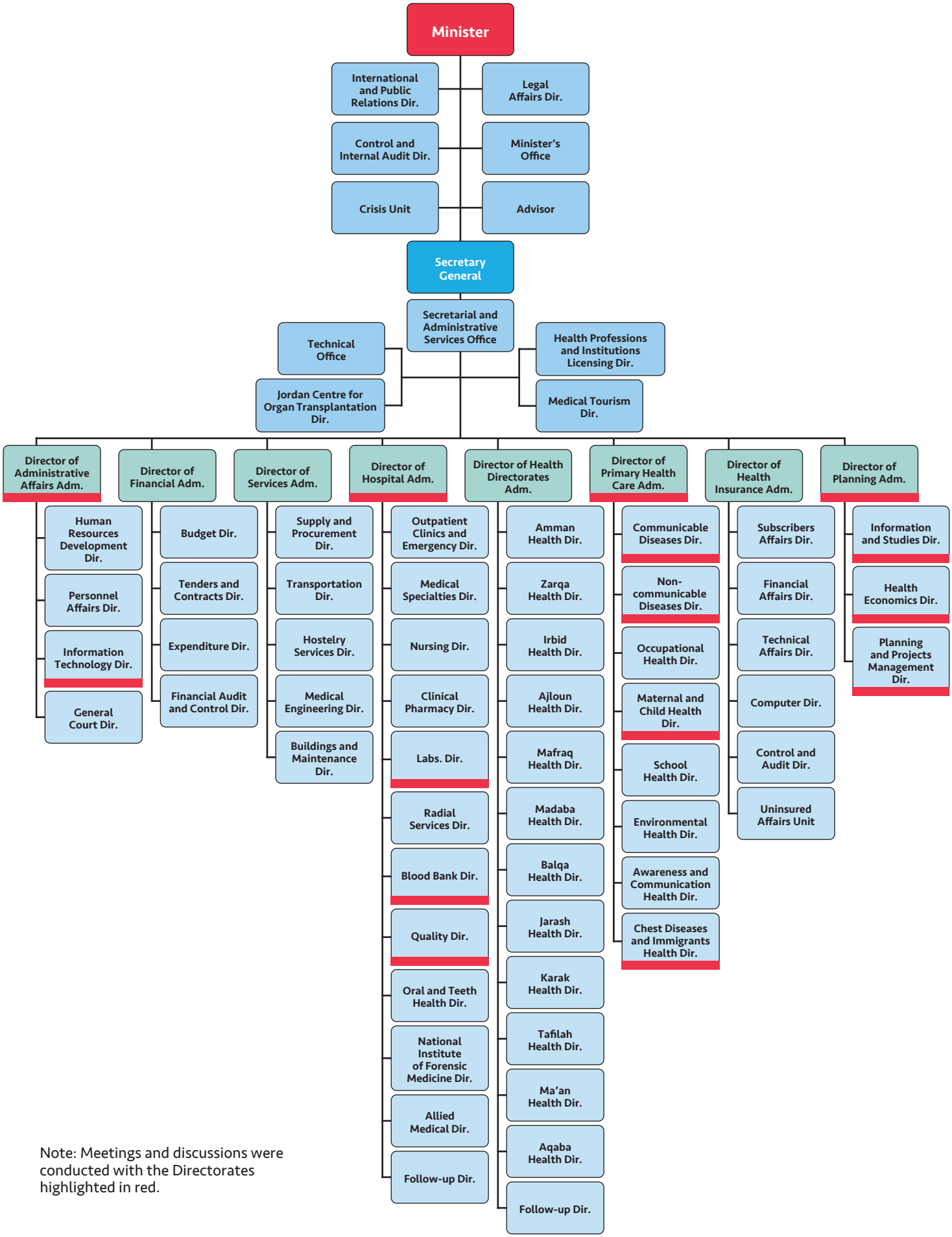


Fig. 6. Schematic overview of strengthening the HIS in Jordan

Annex 1. Ministry of Health organogram



Note: Meetings and discussions were conducted with the Directorates highlighted in red.

Annex 2. Type of information contained in the *Annual Statistical Report*

The *Annual Statistical Report* includes some of the following key statistical information:

- immunization doses and coverage by antigen and district
- notifiable communicable diseases by months, district and governorate
- cancer cases by hospital and type of cancer (without ICD code) and sex
- chronic renal failure cases by hospital and sex and type of health insurance coverage
- workload of emergency departments by hospital
- workload of hospital inpatient and outpatient departments by hospital and type of health insurance
- Ministry of Health inpatient hospital statistics by hospital: total hospital days, percent occupancy and average length of stay
- workload of dental departments by hospitals
- workload of surgery departments by hospital and grade of surgery (major, medium, minor)
- activities of medical laboratories by hospital and kind of investigation
- activities of X-ray departments of public sector facilities
- blood bank activities by blood bank
- incomplete workload of inpatient statistics of private hospitals
- available human resources for all public and private sectors by hospital and districts
- health insurance income and expenditure by hospital and percentage changes.

Annex 3. Inventory of systems

The following is an inventory of the systems which will be reviewed after developing the national health indicator matrix (refer to Table 1).

- health insurance cards systems
- health professionals and institutions licensing system
- procurement and supply system (for drugs and all medical supplies system)
- blood bank and renal dialysis system
- interactive electronic reporting system
- infectious disease system
- Syrian refugees system
- general practice health centres' visitors
- motherhood and child care system
- kidney failure patient records system
- geographic health information systems
- Hakeem
- national cancer registry
- mortality registries
- maternal mortality surveillance and response
- crisis management
- hospital records and reporting
- civil registration and vital statistics systems
- outpatient consultations
- inpatient admissions and discharge
- radiology and laboratory
- surgical operations

Annex 4. Framework for health information systems and core indicators

Health determinants and risks

Demographic and socioeconomic determinants

- Population size
- Population growth rate
- Total fertility rate
- Adolescent fertility rate (15-19 years)
- Net primary school enrolment
- Population below the international poverty line
- Literacy rate among persons 15-24 years
- Access to improved drinking water
- Access to improved sanitation facilities

Risk factors

- Low birth weight among newborns
- Exclusive breastfeeding rate 0–5 months of age
- Children under 5 who are stunted
- Children under 5 who are wasted
- Children under 5 who are overweight
- Children under 5 who are obese
- Overweight (13-18 years)
- Obesity (13-18 years)
- Overweight (18+ years)
- Obesity (18+ years)
- Tobacco use among persons 13-15 years
- Tobacco use among persons 15+ years
- Insufficient physical activity (13-18 years)
- Insufficient physical activity (18+ years)
- Raised blood glucose among persons 18+ years
- Raised blood pressure among persons 18+ years
- Anaemia among women of reproductive age

Health status

Life expectancy and mortality

- Life expectancy at birth
- Neonatal mortality rate
- Infant mortality rate
- Under-five mortality rate
- Maternal mortality ratio
- Mortality rate by main cause of death (age-standardized)
- Mortality between ages 30 and 70 from cardiovascular diseases, cancer, diabetes, or chronic respiratory diseases
- Mortality rate from road traffic injuries
- Mortality rate attributed to household and ambient air pollution
- Mortality rate attributed to unsafe water, unsafe sanitation and lack of hygiene

Morbidity

- Cancer incidence by type of cancer
- Tuberculosis notification rate
- Estimated number of new HIV infections cases
- Incidence of hepatitis B
- Incidence of confirmed malaria cases
- Incidence of measles cases
- Number of people requiring interventions against neglected tropical diseases
- Population at risk of neglected tropical diseases (subject to treatment campaigns)

Health system response

Health financing

- Per capita total health expenditure
- Per capita current health expenditure
- Out-of-pocket expenditure as % of total health expenditure
- Out-of-pocket expediture as % of current health expenditure
- General government expenditure on health as % of general government expenditure
- Domestic general government health expenditure as % general government expenditure
- Population with catastrophic health expenditure
- Population impoverished due to out-of-pocket health expenditure

Health workforce

- Density of health workers: a-physicians, b-nurses, c-midwives, d-pharmacists, e-dentists
- Density of recent graduates of registered health profession educational institutions

Country capacity

- International Health Regulations (IHR) technical areas
- IHR annual reporting
- Joint external evaluation (JEE) score

Health information system

- Birth registration coverage
- Death registration coverage

Medicines and medical devices

- Availability of selected essential medicines in health facilities
- Density per million population of selected medical devices in public and private health facilities

Service delivery

- Density of primary health care facilities
- Hospital bed density
- Surgical wound infection rate
- Annual number of outpatient department visits, per capita

Service coverage

- Demand for family planning satisfied with modern methods
- Antenatal care coverage (1+;4+)
- Births attended by skilled health personnel
- Children under 5 with diarrhoea receiving oral rehydration therapy
- DTP3/pentavalent immunization coverage rate among children under 1 year of age
- Measles immunization coverage rate (MCV1)
- Coverage of service for severe mental health disorders
- Treatment coverage for opioid dependence
- Tuberculosis treatment success rate
- Percentage of suspected malaria cases that have had a diagnostic test
- Percentage of population sleeping under insecticide-treated nets
- Antiretroviral therapy (ART) coverage among all adults and children living with HIV
- Percentage of key populations at higher risk (who inject drugs, sex workers, men who have sex with men) who have received an HIV test in the past 12 months and know their results
- UHC service coverage index

This report presents the findings of a comprehensive assessment of Jordan's health information system undertaken by WHO in 2016 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.