National Integrated Health Information Management System (IHIMS) Roadmap (2021-2030)

Draft

Government of Nepal

Ministry of Health and Population

Department of Health Services

Management Division

Integrated Health Information Management Section

Teku

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List of Abbreviations

API	Application Programme Interface
ARS	Ayurveda Reporting System
DHIS-2	District Health Information System 2
DIN	Drug Information Network
DoHS	Department of Health Services
DQSA	Data Quality Self-Assessment
EHR	Electronic Health Records
EMR	Electronic Medical Records
EWARS	Early Warning and Reporting System
FMIS	Financial Management Information System
GDHI	Global Digital Health Index
GIS	Geographic Information System
HIE	Health Information Exchange
HISPIX	Health Information System Performance Index
HIIS	Health Infrastructure Information System
HuRIS	Human Resource Information System
HSIS	Health Sector Information Strategy
IHIMS	Integrated Health Information Management System
IHMIS	Integrated Health Management Information System
KPI	Key Performance Indicators
LMIS	Logistic Information Management Systems
MD	Management Division
MoHP	Ministry of Health and Population
MPDSR	Maternal, Perinatal Death Surveillance and Response
NDHS	Nepal Demographic Health Survey
NHSS	Nepal Health Sector Strategy
PLAMAHS	Planning and Management of Assets in Health Care System
SDGs	Sustainable Development Goals
SCORE	Survey, Count, Optimize, Review and Enable
TABUCS	Transaction Accounting and Budget Control System
TIMS	Training Information Management System
UHC	Universal Health Coverage
UNFPA	United Nations Population Fund
USAID	United States Agency For International Development
WHO	World Health Organization

Acknowledgements

Over the years, there has been considerable progress in strengthening health management information systems in Nepal. The national health policies and strategic plans have clearly articulated the emerging needs for coherent and integrated framework to promote monitoring, evaluation and e-health architecture in the context of federal governance. Given the context of diversity and multiplicity of the health information systems, the roadmap for integrated health information management systems primarily aims to further build on the existing health information systems and propose for integrated health information architecture which enables interoperability of data flow across these systems and contributes to better use of data and information for decision making at all levels.

While all the health information systems and data sources are in various states of development and functionality with limited sharing and coordination, the proposed e-Health architecture framework and IHIMS roadmap will further strengthen planning, coordination, and implementation of the proposed architecture blueprint among all stakeholders, particularly government and implementing partners at all levels.

The IHIMS roadmap has been developed with the leadership of Management Division of Department of Health Services in close consultations with a range of government stakeholders, development partners and experts at federal and province levels to with their inputs, perspectives and expertise for this roadmap. The process is led by IHIMS section chief Mr. Badri Nath Gnyawali and his team including Mr Bir Bahadur Rawal, Shiv Lal Sharma and Diwakar Sapkota. I appreciate their hard work to bring out the roadmap successfully.

We greatly appreciate the significant technical inputs and guidance from Mark Landry, Regional Advisor, SEARO WHO, Dr. Md Khurshid Alam Hyder, Public Health Administrator, Dr. Khin Pa PaNaing, Technical Officer, Mr. Paban Ghimire, National Professional Officer and Jhabindra Bhandari, Technical Expert from WHO Country Office. We also acknowledge the inputs and contributions from provincial health authorities and development partners during participatory consultations and interactions for developing the roadmap.

Director General
Department of Health Services

Executive summary

The Ministry of Health and Population has consistently made significant progress in health information management systems with the use of information and communications technology (ICT) in the health sector. The e-health strategy has offered options for digitalization of the data system. Health Information Systems are found critical for achieving better health outcomes, including making progress towards Universal Health Coverage (UHC), the Sustainable Development Goals (SDGs) and improving health service delivery and patient care through evidence-based planning and decision making.

This roadmap marks the pathway for scaling up and sustaining health information systems and eHealth solutions that are standardized and increasingly interoperable that will lead to better quality and complete information, resulting in better decisions and better health outcomes. This further builds on the existing progress made in the integrated health information management system (IHIMS) and emerging needs of scaling up of integration with other health information systems for better alignment and functional linkages to harness the potential of a broader national architecture and e-Health governance.

The roadmap highlights both the strategic and historical context of health information management system in Nepal. Based on the existing situation of Routine Health Information Systems (RHIS) and the strategic directions of e-health, the roadmap proposes a system building approach and highlights the much-needed digital governance to ensure effective implementation of e-health strategy and architecture. The RHIS governance should be enhanced to operationalize the roadmap with the support from proper institutional settings and mechanism.

System building for demand-led health information is the fundamental strategy adopted in the roadmap. A systematic profiling and registry of all the current and planned information systems and eHealth solutions using the WHO Digital Health Atlas can accompany the eHealth architecture blueprint to foster better planning, coordination, and implementation of the architecture blueprint among all stakeholders, particularly government and development and implementing partners. Outcomes envisioned in the roadmap have linkages to all the aspects of ideal information architecture ranging from system building for better data management to addressing different user group needs and placing data as public good. The roadmap is followed by implementation plan that identifies key activities for RHIS governance, programme management and operationalizing next steps towards achieving better health information eco-systemthat needs stronger commitment from health planners, program managers, experts and all the stakeholders for success.

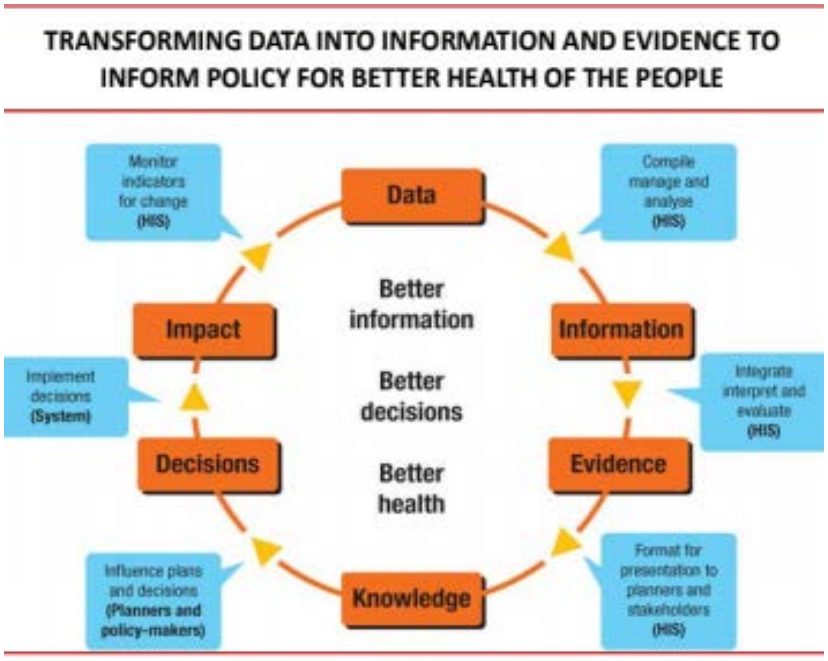
1. Background and strategic context

Health information is one of the six building blocks of the health systems as identified by the World Health Organization (WHO).[1] The health information block contributes to the strengthening of health systems as cross cutting support component.

Information is needed to track the health systems performance and measure inputs, processes, and the impact. Sound, complete, timely and reliable information is the foundation of evidence-based decision-making across all dimensions of health system strengthening. The health information system has four key essential functions: data generation, compilation, analysis and synthesis, and communication and use. The system aims to collect data from health and other relevant sectors, analyze the data and ensures their overall quality, relevance and timeliness, and converts data into information for health-related decision-making (Fig. 1).

This implies the need to define core indicators of health system performance while developing and implementing appropriate sustainable measurement strategies to generate the required data. However, on the supply side, there are major gaps in timely data availability and building confidence for using the data produced in relation to adequacy and quality. Some developing countries are able to produce data of sufficient quality, adequately analyzed, interpreted and used for effective policy, planning and to permit the regular tracking of progress in the health sector.

Fig. 1: Transforming data into information and evidence to inform policy for better health of the people[2]



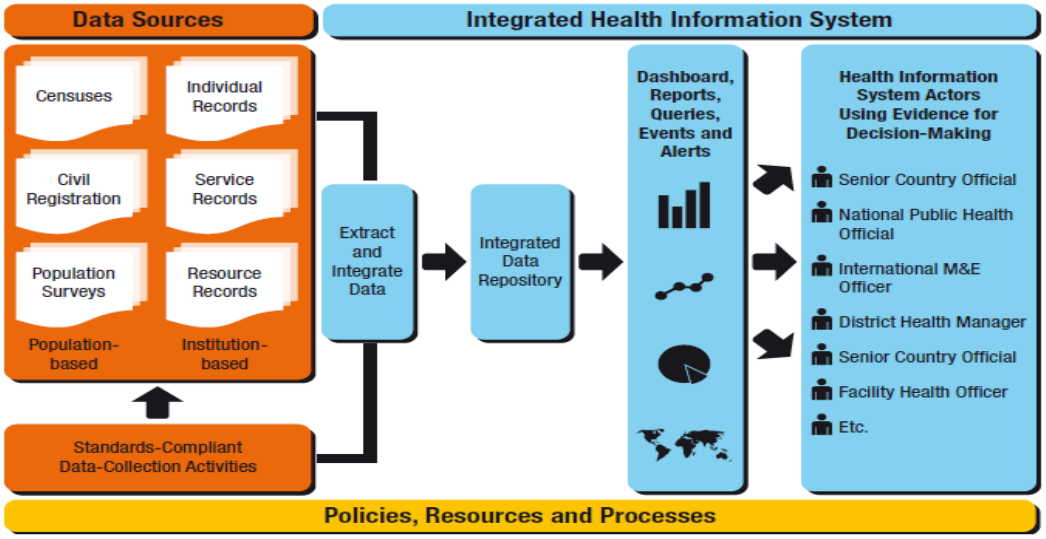
In Nepal, health policies have largelyunderscored the needs and priorities for investments in health information system. There are many streams of information systems in health sector. These mainly include health management, surveillances, logistics, financial, health infrastructure, human resources, training, drug, and others.

[1]Everybody business : strengthening health systems to improve health outcomes : WHO's framework for action. Geneva: World Health Organization. 2007 (https://www.who.int/healthsystems/strategy/everybodys_business.pdf)

[2]Framework and standards for country health information systems, 2nd edition. Geneva: Health Metrics Network, World Health Organization. 2012 (https://www.who.int/healthinfo/country_monitoring_evaluation/who-hmn-framework-standards-chi.pdf)

Therefore, an integrated health information architecture is envisioned to better coordinate and harmonize health information from a range of data sources that are timely extracted and integrated for repository which provides evidence through dashboard, reports, events and alerts, and those can be used by policy makers, planners and programme managers for decision making (Fig. 2).

Fig. 2: Integrated health information system architecture framework[2]



While there have been significant efforts to initiate reporting of disaggregated data by age, sex, caste and ethnicity in the HMIS, the scope of health information systems has further widened in terms of monitoring universal health coverage (UHC) and the health-related Sustainable Development Goals (SDGs). Therefore, innovative approaches and smart eHealth interventions are needed at all levels to ensure timely reporting, analysis and use of evidences for decision making.

In the federal context, data collection, management, analysis and use require clear direction and a roadmap to optimize the investments and measure health impacts efficiently. The foremost priority is to visualize e-health architecture and related investments so that appropriate data policies and actions could be realistically designed. This will further help in creating a foundation of interoperable and sustainable information exchange to improve evidence-based policy making and planning in the federal context.

In addition, there are critical needs to promote the appropriate use of digital technologies for health and create an environment for system integration and standards-based interoperability to improve data and information flow and use. While information and communications technologies present new opportunities and challenges, there is a growing consensus in the health community that the strategic and innovative use of digital technologies is key to harness evidence-informed health policies and actions. Within the limited resources there is need to strengthen and improve the existing information systems and their interoperability to develop Integrated HIS.

1.1 Policy Landscape

The Constitution of Nepal 2015 has ensured every citizen the provision of basic and essential health services from the state as a fundamental right and considers the importance of healthy and productive citizens in national development. It is the state's responsibility to ensure quality and equitable access to universal health care by

increasing investment in the health sector[3]. As per the constitution's sole and concurrent rights, the responsibility of health has been given to all levels of government with the activities including health policy, guideline development, quality assurance, monitoring, prevention and control of communicable diseases.

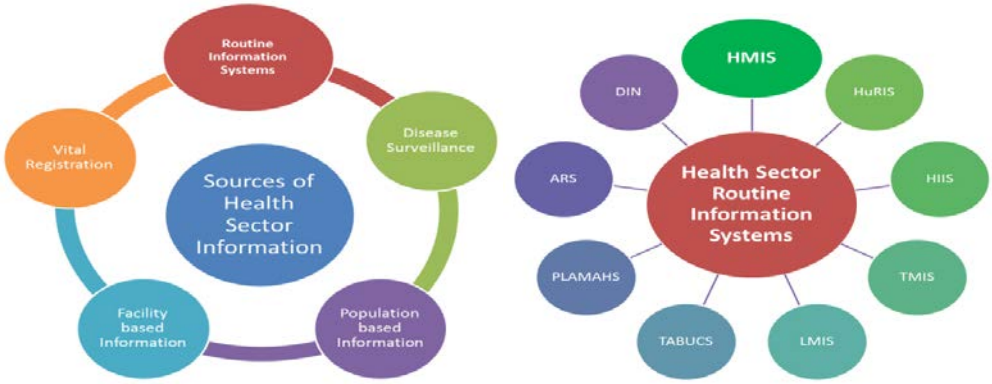
Nepal's 15th Development Plan (2019/20-23/24) sets a goal of ensuring access to quality health services at the population level by strengthening and expanding the health system at all levels. The plan clearly articulates a new strategy to further systematize, strengthen and optimize the use of existing health information system in planning, monitoring and evaluation and evidence-informed policy making.

In line with federalism, Ministry of Health and Population (MOHP) has formulated national health policy (2019) that broadly highlights the advancement of health information system complying to the development in information and communication technology. One of the strategic outcomes of Nepal's health sector strategy (2015-2021) is improved availability and use of evidence in decision making processes at all levels. More focus is on e-health strategy, roll out of unified codes to ensure interoperability of different information systems, create central data repository, initiate electronic recording and reporting systems, and build institutional capacity for generation, processing, analysis and use of information at all levels.

In this context, Health Information System Strategy (HIS) was developed in 2007. Based on this strategy, new system enabled with provision of disaggregated data by gender and caste/ethnicity were piloted in three districts: Lalitpur, Parsa and Rupandehi. The strategy mainly aims to strengthen existing health information systems that contributes to implementation of Nepal health sector strategies, periodic development plans as well as measuring the health outcomes and impact.

In 2008, with the expansion of Internet access in Nepal, the Logistics Management Division (LMD) developed computerized logistics system that could be shared through a web-based interface. Realizing the benefits of a more integrated system, the LMD took a decisive step to implement a web-based LMIS, as well as an inventory management system.The existing health sector information includes a variety of sources from routine and non-routine health information and diseases surveillance, as well as other domains such as human resources, training, logistics, drugs, traditional medicines, finance and others, which are illustrated below (Fig. 3).

Fig. 3: System of health data sources and health information systems



1.2 Rationale for the Roadmap

Review of health information systems practices in most of the developing countries reveals that there are critical needs of improved coordination for integrated health system across other sectoral departments, ministries,

[3]15th Five Year Plan (2019/20-2023/24), Government of Nepal

private sectors and partners. Therefore, many countries have started e-health planning and implementation of integrated health information management systems (IHIMS) as an integral part of health care management.

Global status report on health data systems and capacity (SCORE) report, 2020 prepared by WHO has showed Count (births, deaths and causes of death) and Enable (data use for policy and action) as major gap in the Nepal HIS. Other components of SCORE,Survey (population and health risks), Optimize (health service data) and Review (progress and performance) are found moderate in terms of availability, practice and implementation.

The recent Assessment of Routine Health Information Systems (RHIS) 2020 has also revealed that the governance, management and decision support aspects of the RHIS are considered as major gaps and challenges at the federal level where as management, governance, data analysis, dissemination and use are the areas where more technical support and capacity building is needed to strengthen the health information systems at the province and local levels. Out of 59 indicators in Health SDGs and part of nutrition related, routine health information systems serve for 32 indicators but none in complete due to its nature of facility-based reporting. It indicates routine health information systems are useful for monitoring the SDGs through the proxy indicators.

Data collection, management, analysis and use within an IHIMS under federalism in Nepal requires clear direction and a roadmap to optimize investments and maximize health impacts. As forced by advancement in the technology and increasing demand for integrated and inter-operable information systems and partnership for data beyond health, RHIS reform is mandated to satisfy the need of all sides. In the recent years, the scope of HMIS haswidened ranging from measurement to supporting the service delivery. Many issues and needs in IHIMS strengthening have been identified by many stakeholders and will next require prioritization and appropriate sequencing to form the basis for an integrated and comprehensive IHIMS roadmap to be developed and implemented effectively.

To address the existing gaps and synchronize with advancement in technology, IHIMS section of Management Division intends to develop a strategic roadmap for IHIMS and come up with overarching framework and architecture of Routine Health Information Systems (RHIS) in the context of federalized health structure.

1.3 IHIMS roadmap development process

The methodological approach for developing the roadmap primarily included desk review of business processes, work and data flows, and existing national health policy, strategy, and guidelines and practices at national, regional and global levels. Key informant interviews with government's focal points and managers, development partners, academia and research institutions involved in health information systems were conducted. In addition, participatory consultation meetings were held with technical working groups on IHIMS, senior officials of the government and development partners at federal and province level. The whole process is coordinated and led by IHIMS section of the Management Division with the lead technical support from WHO.

As suggested by Framework and Standards for Country Health Information Systems and Health Metrics Network WHO, six components of health information systems are followed in the roadmap development process.

Inputs: Health Information System Resources (HR, logistics, finance)
Process: Indicators, data sources, data management
Outputs: Information products, dissemination and use

Following the consultative workshops at Kabhrepalanchok (2019) and Sauraha workshop, the roadmap development process expedited through IHIMS TWGs and health partners. The purpose is to reform the existing systems in order to pave way for fully digitalized, integrated and inter-operable health information systems

ensuring full access to users on quality health data. Starting from system building and sustainability of the health information, key beneficiaries are identified as people and health clients, service providers, planners and program managers and external data user communities.

The roadmap consists of 30 outputs to achieve six outcomes focusing on system development, benefitting people, service providers, planners and program managers, data user and research communities. Three phased strategy is adopted; first phase for improving existing system, second phase for transitional arrangement for full digitalization and standardized system and third phase for achieving full digitalized, standard and robust RHIS. To achieve this, an implementation plan is prepared with set of interventions corresponding to outputs and outcomes.

2. Situation analysis

2.1Historical development of IHIMS in Nepal

In the recent years, there are critical needs of reliable and timely health information which provides a solid foundation for improving health outcomes and strengthening health systems and service delivery. Therefore, sound health information is a global public good that requires smart investments by governments, development partners, health policy makers, statisticians, community-based organisations, and private sector.

In response to the health challenges they face, many developing countries have launched reforms of their health systems and as part of those reforms they have undertaken to expand and improve their health information system (HIS). Analysis of the health information landscape suggests that countries are moving from the established paper-based system to the “second generation” HIS, where health data is used to not only inform policy but to improve care at the point of service delivery.

Nepal has a century long history of statistical activities in health, initiated from Malaria Surveys conducted in the inner Terai region in 1925 and routine data collection and reporting was planned in 1958 with USAID support. Further, Nepal Health Survey 1964 conducted when family planning and maternal and child health campaigns started in the country. Gradual expansion of other health programs resulted in various vertical information system until Department of Health Services established in 1993 that integrated all health programs including information systems. In the recent years, there are different health information systems available in the health sector that needs to be better coordinated and harmonized to optimize the use of data for decision making.

In this context, Ministry of Health and Population with the support from UNFPA and USAID first ever developed health management information system (HMIS) in 1993 integrating existing vertical information systems. This system collects health information from public and private sector and supports routine decision making to improve access to and use of quality health services, enhance evidence-based planning and management, monitor and improve the performance of health sector at large.

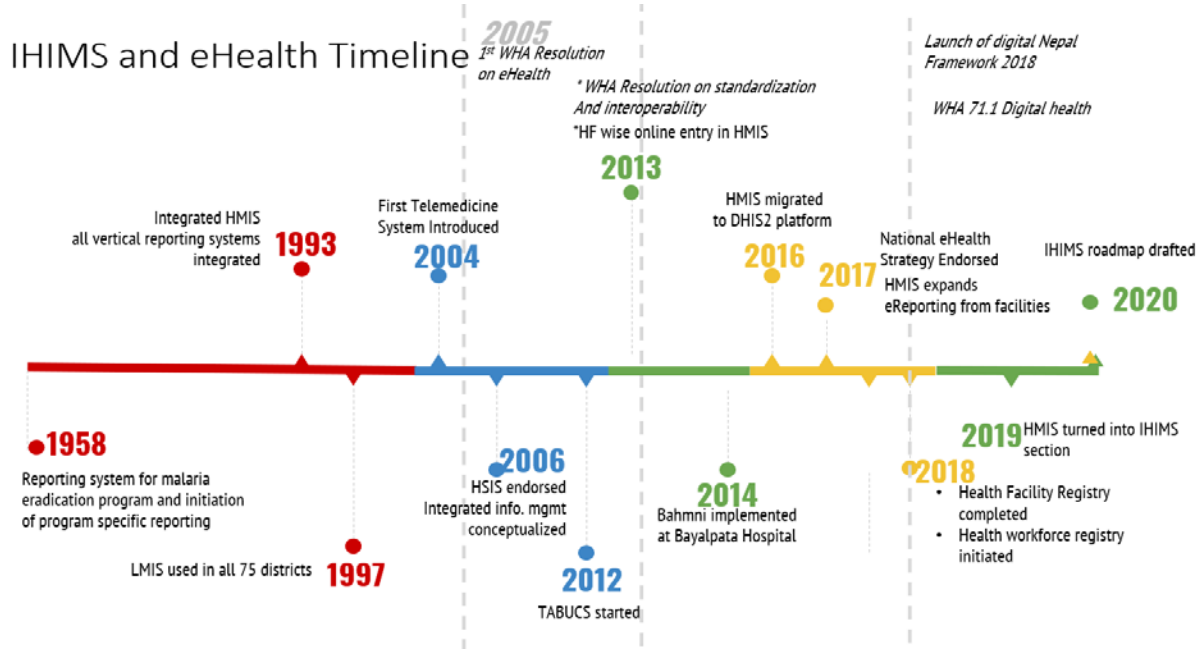
Web-based data entry and management system has been in function supported by advancement in the technology. More importantly, efforts are in place to scale up a free and open source and health management data platform District Health Information System (DHIS-2) since 2014. However, there are still some challenges to improve the capacity of health workers and managers in data analysis and use of data for evidence-based planning and management of health services at both province and local levels. In remote health facilities, there is limited access to internet and infrastructure. Periodic review, follow up, and monitoring are essentially needed to improve quality of health information and timely reporting across the country.

In Nepal, the first integrated health management information system was established in 1993. After this, with the support from key development partners, there has been several efforts and progress to expand the scope and strengthen the IHIMS. In addition, the initiation of LMIS across the country in 1997 was a major landmark in the logistics management information system. Similarly, and first telemedicine system in 2004, health sector information strategy (HSIS) in 2007, TABUCS in 2012, HF wise online entry in HMIS in 2013, HMIS and EWARS migrated to DHIS2 in 2016/17.

Currently, HMIS aggregates e-reporting from almost all public primary care centres and 88 percent hospitals are major landmarks including COVID-19 reporting progress and dashboard management. LMIS reporting is done by 80 percent of the public health institutions. However, timely reporting (within 15 days of closing of month) for HMIS from primary care units is 42 percent and that of hospitals is 14 percent. Till date 8772 health facilities are registered in the HMIS including 6366 governmental and other non-governmental. Out of the total reports received, 26 percent are entered by health facilities themselves through DHIS2 online platform and other report entry is assisted by municipalities and district level health offices. The online entry rate of monthly report is increasing as roll out of DHIS2 orientation.

In this context, the MoHPhas recently implemented the integration of Health Management Information System (HMIS), Logistics Management Information System (LMIS) and Health Infrastructure Information System (HSIS) and managed through Integrated Health Information Management Section (IHIMS). Gradually, the Division intends to integrate other health information systems based on the strategic directions of the IHIMS roadmap and implementation plan.The historical development of IHIMS is summarized below (Fig. 4).

*Fig. 4:*IHIMS and e-Health timeline



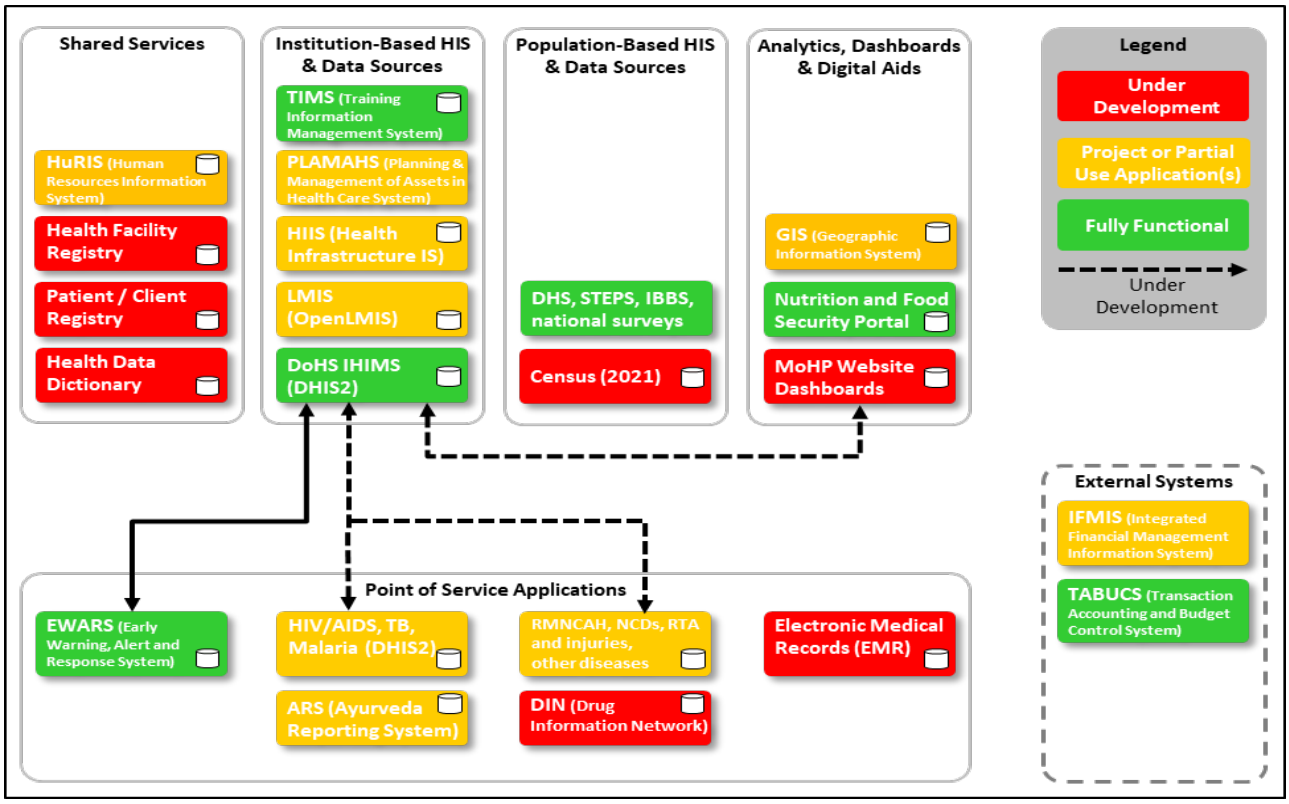
Under the Ministry of Health and Population (MoHP) there are 10 major health information systems.

1. Health Management Information System (HMIS)
2. Financial Management Information System (FMIS)
3. Logistics Management Information System (LMIS)
4. Health Infrastructure Information System (HIIS)
5. Planning and Management of Assets in Health Care System (PMAHCS)
6. Human Resource Information System (HuRIS)

7. Training Information Management System (TIMS)
8. Ayurveda Reporting System (ARS)
9. Drug Information Network (DIN)
10. Early Warning Alert and Response System (EWARS)

The MoHP has endorsed the national e-health strategy-2017 and Roadmap 2019 and the Government's e-governance and interoperability framework-2010 recommends standards and specifications to make systems interoperable and maximize the use of free and open software systems (FOSS). Therefore, the proposed e-health architecture is grounded on national ownership and governance, programme management, adequate institutional capacity, and a ICT and e-health infrastructure as a foundation. Fig. 5 illustrates the "current state RHIS and eHealth architecture based on the existing and planned ICT investments.

Fig.5:Current state RHIS and e-Health architecture framework and IHIMS roadmap



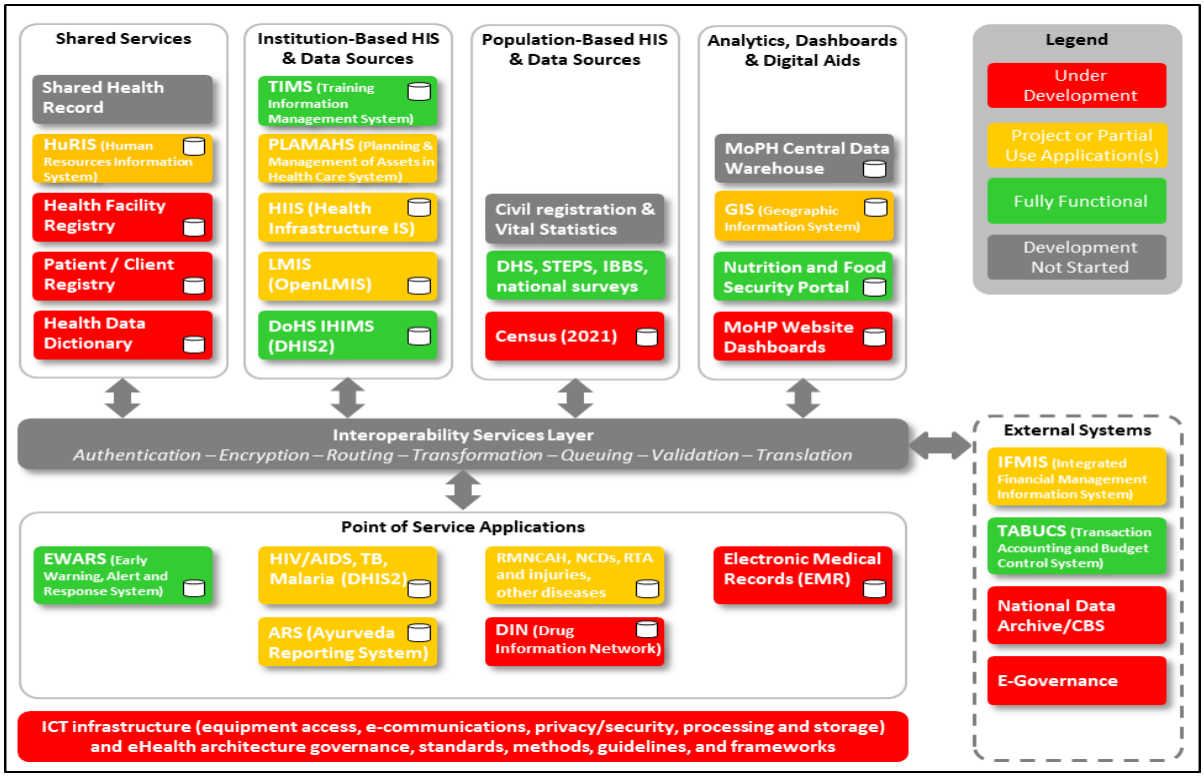
All of the current systems, shared services, and data sources are in various states of development and functionality with very little interaction between solutions. A systematic profiling and registry of all the current and planned information systems and eHealth solutions using the WHO Digital Health Atlas[4] can accompany the e-Health architecture framework and IHIMS roadmap to foster better planning, coordination, and implementation of the architecture blueprint among all stakeholders, particularly government and development and implementing partners.

The future e-Health architecture (based on the OpenHIE[5] framework) will require significant investments to operationalize a fully-functional open-standards based interoperable environment of information systems and eHealth solutions (Fig. 6). This IHIMS roadmap is aspirational in many ways but also a pragmatic guide and

[4] World Health Organization. Digital Health Atlas. (https://digitalhealthatlas.org/).
[5] Open Health Information Exchange (OpenHIE) architecture framework. (https://ohie.org/architecture/#framework).

recommendation in other ways. Prioritization is required through the e-Health architecture and IHIMS governance, principles, processes and standards under development to determine which components of the roadmap shall be implemented at each phase to optimize the limited resources available. Current and planned applications and technology will need to be re-configured or adapted to incorporate the use of data standards and interoperability profiles with data exchange standards and software interfaces that are compliant with the architecture in the future.

Fig. 6: Future state e-Health architecture framework and IHIMS roadmap



Many gaps in the architecture remain, particularly systems and components where development has not yet started or still under development as well as bringing project-based or partial use applications to scale that will fit within the future framework and IHIMS roadmap. Additionally, many of the point of service applications that work with patient-based data across various programmes(e.g., HIV, TB, Malaria, RMNCAH etc.) and emerging priorities like NCDs and mental health will need to be consolidated or inter-linked across electronic medical records (EMR) systems that comply with the future shared health record requirements.

Possibly the most significant and complex technology to be implemented in the future e-Health architecture is the *interoperability service layer*. This is essentially a "middleware" system, or specialized software and application programme interfaces (APIs) used to handle a series of electronic data functions—namely data authentication, encryption, routing, transformation, querying, validation, and translation—between all components of the HIS architecture. Other key features of the future state architecture include creation of a data warehouse as well as the need for fully-functioning shared services required for patient/client, health workforce, and facility registries and a shared health record enabled with a unique identifier (ID) to enable health information exchange (HIE) capability across the interoperability layer.

2.2 Issues and priorities

In the changed federal context, there are specific issues and priorities to be addressed in the existing health information management systems.

- Health data and e-Health governance mechanism for optimal oversight and accountability
- Programme management for managing processes, risks, changes, costs, and scope
- Strengthening IHIMS and other systems and platforms including a future data warehouse
- Coordination and harmonization of other health information systems and the use and adherence to standards for integration and interoperability
- Adequate human resources and IT infrastructure for all levels for information management
- Capacity building for improving data quality, analysis, interpretation, and use for better decision-making
- Technical assistance to provincial and local governments, and health facilities to ensure timely reporting, data completeness and data quality.
- Tracking the progress on Universal Health Coverage and health-related SDGs

There are critical needs to advocate and enhancing the practice of data-driven planning and decision-making at all levels of management in the federal context. In addition, issues around data safety, security as well as open data system and sharing to the pubic need to be further considered in the IHIMS.

3. Guiding principles

In addition to adhering to the global principles for HIS and digital development,[6] there are some additional principles to be applied:

- Adherence to the constitutional provisions and functions of governments
- Respect people's right to health information
- Strengthened coordination and partnership with a range of stakeholders from government and non-government sectors
- Integrated approach for cost-effective, standardized, efficient, inter-operable and user-friendly health information systems
- National ownership and accountability

4. Strategic Directions

- Governance and Institutional Capacity Strengthening
- System Improvement
- Capacity building and Advocacy for data-driven planning and decision making

Vision

- Better information, better decision, better health and well-being of people

Mission

- Ensure coordinated and efficient integrated health information architectures enabled for strengthening health systems and achieving UHC and the health-related SDGs

[6]Principles for digital development. (https://digitalprinciples.org/)

Goal

- Increased access to and use of high-quality health data and information for evidence-informed decision making

Objectives

General objective of the Roadmap and Implementation Plan is to visualize the outcomes and outputs of the routine health information systems and identify the interventions and activities for achieving that to satisfy the information needs of the health sector.

Specific Objectives

- To develop a national IHIMS roadmap and eHealth architecture for ensuring availability and use of quality health data and information for decision making
- To direct for strengthening the existing health information systems and health data sources and recommend for the sustainability by forging partnership

5. Delivering the outcomes and outputs

1. Well regulated, capacitated, contemporary, integrated, inter-operable, technology enabled and sustained health information system functional at all levels

   Developing sustainable system
   A robust system backed by rules, regulations, skill mix competent human resource, well managed and participatory process and technology that is sustainable, feasible and acceptable lead to deliver information products with easy of management, access, utilization and security regardless of effect of changes in the actors, means and logistics. A fully digitalized, integrated and inter-operable information system achieved in phased manner can satisfy information demand of all sides and allow systematic approach for information management including system integration. Accountability, transparency and responsiveness of governance units are gained through better communication of health data.

2. Better management of data repository and enhanced ownership by citizens

   Establishing information systems and health data as public goods and asset
   Health data provides the health situation and services in the country for reference dates or periods. These systems are public property and the products have value in terms of trend analysis and health related information in chronological order. Ownership of the people lies as data provider and consumer. These assets must be preserved and make available to the people in future.

3. Ensured right to information and making citizens satisfied of their health needs with better availability, access and utilization of health information products

   People and health service clients as beneficiaries
   People centered demand-based information products support citizens to understand their health situation, risk factors, service need, and support them to access and utilize health services well. Information systems can save citizens from emergency health situations and all hazards by providing them health information

continuously and friendly manner. Enabling people with information on availability, accessibility, distribution and acquisition of health services enhance their choices and satisfaction.

4. Adequate and accessible health information products for supporting better health service delivery

   Increasing efficiency for service delivery, health service providers as beneficiary
   Health information system support to build efficient and effective service delivery and equip health care providers with all varieties of information required for better service delivery. Better planning and accommodation of service delivery outlets, demand and supply analysis, sustained memories for patient care, identifying and predicting the service recipient and service delivery capacity enable health workers for delivering timely and efficient service delivery.

5. Standard, timely, adequate and quality health information for better health policy, plan and program management at all levels

   Planners and program managers as beneficiaries
   Timely, reliable, easily accessible and complete information on various aspects of health situations including morbidity and mortality, resources, distribution of health services provides essential base for health policy and plan development, implementation, monitoring and evaluation. Integrated information supports planners and programme managers to understand the health situation, availability of resources and deploying resources efficiently.

6. Adequate and quality health data for research, innovations and meeting mutual interest of stakeholders for partnership

   Academician and data user communities as beneficiaries.
   RHIS produces bulk of information products on health situations, determinants of health, resources and utilization of health services among many other in the form of information and dataset. These data have big value for academicians and research community. Information products are also usable to national, regional and global communities and agencies engaged in health services and data services. Research and development exercise for health data infrastructure, system, process and business process will further support to strengthen health information systems, increase credibility and assess the strengths and gaps. Partnership forging is essential for strengthening the health information systems and optimizing the health data.

6. Output matrix

Strategic Objective 1: Develop a national IHIMS roadmap and eHealth architecture for ensuring availability and use of quality health data and information for decision making	Outputs	Achievement phase Short-term (2021-2022) Medium term (2023-2024) Long-term (2025-2030)
Outcome1 Well regulated, capacitated, contemporary, integrated, inter-operable, technology enabled and sustained health	Regulation, guidelines and standard operating procedures for routine health information system available and implemented	Short term
	Capacity developed for data generation, management, analysis and use	Short term

information system functional at all levels *Developing sustainable system*	Updates available on situation of data requirement, technology and methods	Short term Medium term
	Mechanism and process for integrated health information management system established	Short term
	Improved functional linkages and alignment with different health information systems and data sources	Short term Medium term
	e-reporting of health information systems aggregated and scaled up to all levels	Short term
	Inter-operability standards are developed and used in all health information systems (HF registry, National ID, Client registry, HR registry, service registry, logistics, app/solutions registry etc.) in line with eHealth strategy	Short term
	Provincial Health Information Hubs for HIS established and strengthened (staff, units, resources, equipment and infrastructure)	Short term Medium term
	Resource mobilization mechanism for health information systems established at all levels	Short term Medium term
	HR Development Plan prepared for health information management (Curriculum, training, Continuous Professional Development)	Medium term
	Software assessment and audits conducted periodically.	Short term Medium term
	All the health facilities are made fully digitalized (EHR, EMR etc.)	Medium term Long term
	Digital governance framework developed and implemented	Short term Medium term
Outcome 2 Better management of data repository and enhanced ownership by citizens *Establishing information systems and health data as public goods and asset*	Adequate data security measures taken for health data	Medium term
	Single and security enabled data repository and backups maintained	Medium term
	Metadata created for all health data sets	Short term Medium term
	Public concern on health data responded	Medium term Long term
Outcome 3 Ensured right to information and making citizens satisfied	People informed of community health situation, health alerts, health service availability, and health service-related offers	Short term Medium term

of their health needs with better availability, access and utilization of health information products. *People and health service clients as beneficiaries*	Data literacy programs for public initiated	Medium term
	Digital Health Atlas developed and updated	Short term Medium term
Outcome 4 Adequate and accessible health information products for supporting better health service delivery. *Increasing efficiency for service delivery, health service providers as beneficiary*	A common platform among MoHP, councils, departments, other relevant ministries, and non-state sectors on generation, availability and use of information established	Short term Medium term
	Data need for service providers identified, collected, analyzed and made accessible for health service delivery efficiently	Short term Medium term
Outcome 5 Standard, timely, adequate and quality health information for better health policy, plan and program management at all levels. *Planners and program managers as beneficiaries*	Data quality assurance mechanism developed and implemented	Short term Medium term
	Data need for planners and program managers identified, collected, analyzed and made accessible for planning, monitoring and decision making	Short term Medium term
	Strengthened practice for data use	Short term Medium term
	Planning manual consist of data use provisions and complied	Short term Medium term
Strategic Objective 2: To direct for strengthening the existing health information systems and health data sources and recommend for the sustainability by forging partnership Outputs		Achievement phase Short-term (2021-2022) Medium term (2023-2024) Long-term (2025-2030)
Outcome 6 Adequate and quality health data for research, innovations and meeting mutual interest of stakeholders for partnership *Academician and data user communities as beneficiaries.*	Linkages with national data agencies and other relevantexternal systems and platforms are established (Population data, CRVS, nutrition, HR, education etc.)	Short term Medium term
	Health data identified and supplied for measuring progress against UHC and SDGs	Short term Medium term
	Culture of implementation research and operational research on various aspects of health information established	Short term Medium term
	Build partnership with levels of government, non-health agencies, research communities, academia and health partners to strengthen the health data	Short term Medium term

7. Monitoring & Evaluation Framework for IHIMS roadmap implementation

The IHIMS roadmap calls for periodic monitoring and evaluation of the maturity level of functionality and optimization at federal, province and local levels and aims to assess the implementation of the e-Health architecture through standard measures. These measures should include both the status and performance of e-health interventions and include established monitoring and evaluation models to facilitate monitoring of the contribution of e-health to achieving strategic health outcomes, health system processes, health workforce processes and individual health benefits and needs. This roadmap and the set of outputs will help to track progress and enhance accountability towards attainment of universal health coverage, the Sustainable Development Goals. Health Information System Performance Index (HISPIX) — a summary measure based on the key standardized indicators for assessing data quality and the overall performance of the health information system could be used at the federal and province levels.

In brief, the indicators are largely related to data generation, periodicity, timeliness, contents, tools and availability of data for health system strengthening. Other indicators are related to national capacities for synthesis, analysis and validation of data. These measure key dimensions of the institutional frameworks needed to ensure data quality, availability, coordination mechanisms and availability of microdata and metadata. Consideration is given on system strengthening for better health data and optimize the use of data. The interventions are aligned to health sector plans and policies including eHealth strategy.

Policy planning and monitoring division will monitor the implementation of the roadmap with close collaboration and support of Management Division. Periodic reviews are suggested to oversee and monitor the progress against set time line. The PPMD, IHIMS section and Provincial MoSD would continue to develop and refine a monitoring and evaluation framework for this roadmap, The Health Information System Performance Index (HISPIX) and Global Digital Health Index[7] (GDHI) are the tools available for monitoring and evaluation used by many countries.

8. Risk Analysis for IHMIS Roadmap implementation

In the changed context of federalized health structure, there are still challenges and uncertainties in terms of effectively implementing the interventions for health information systems. At federal level, there are different health information systems across the ministry of health and population, and there exists limited sharing and coordination across departments, centres and divisions which limits the prospects of integration and interoperability to foster better use of data and information for decision making at all levels. While provincial governments are in early stage of developing their own health policies and strategic guidelines, there are critical issues around trained human resources, physical infrastructure, IT resources and technical capacity of provincial and local governments to implement the activities as envisaged by the roadmap. Hospitals share large of health service data mainly on morbidity and mortality but governance for them is decentralized at federal, province and local levels. Similarly, primary care units are under local levels. In this scenario, the indirect chain of communication, unpredictability of resources, non-compliance to standards and other governance and institutional limitation may float uncertainty of proper implementation., Furthermore, the resource investments in times of post-COVID-19 and other health emergencies might be limited for implementation of IHIMS roadmap. Therefore, both technical and financial assistance from the development partners as well as from the MoHP and

[7] Global digital health index. (https://www.digitalhealthindex.org/)

DoHS is needed to address the critical needs of human resources and support for IT infrastructure at sub-national levels will be required to move this roadmap forward.

9. Plan for Sustainability

In order to ensure continuity and sustainability of the e-health architecture and governance, the government and development partners need to consider increased investments in infrastructure, capacity building, developing tools and methods, monitoring and evaluation. In addition, a high-level multi-sector oversight and support mechanism is needed for necessary guidance and policy provisions. Similar mechanism is needed at sub-national levels. These mechanisms will ensure increased commitments for resource mobilization, promote and support the implementation, make review, monitor and evaluate the HIS and e-Health architecture for better production, sharing and use of data and information across all levels.

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Implementation Plan for Integrated Health Information Management Systems Roadmap

Outputs	Major interventions	Responsibility	Timeframe (2021-2030)										Deliverable
			2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	
Outcome 1: Well regulated, capacitated, contemporary, integrated, inter-operable, technology enabled &sustained health information system functional at all levels.													
Regulation, guidelines and standard operating procedures for routine health information system available and implemented	Review existing regulation for routine health information systems and support incorporating provisions in the regulations.	MoHP	X	X	X	X							Regulations with sufficient provisions for RHIS operations
	Develop Guideline and Standard Operating Procedures (SOPs) and indicator reference sheet for IHIMS including provincial hubs and local levels.	IHIMS	X	X									SOPs are available at all levels including hospitals
Capacity developed for data generation, analysis, management, and use	Develop training packages for RHIS including web based and support curriculum for public health informatics	IHIMS/NHTC	X	X	X	X							Curriculum and training packages
	Develop training packages for hospital information management with focus on ICD, birth and mortality data	IHIMS/PPMD/ NHRC	X	X	X								Training package for hospital
	Develop mentoring arrangement and exchange visits through provincial information hubs	IHIMS/PPMD/ MoSD/HCD		X	X	X							Number of mentors
Update on situation of data requirement, technology and methods	Develop methods, models and techniques for data analysis, estimations and data use complying to standard practices	IHIMS/EDCD/ PPMD/NHRC		X	X	X							Manuals developed
	Conduct RHIS Assessment periodically	IHIMS/PPMD		X			X			X			RHIS assessment reports

Outputs	Major interventions	Responsibility	Timeframe (2021-2030)										Deliverable
			2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	
Mechanism and process for integrated health information management system established	Support M and E TWG at federal and provincial levels with provisions of health data support, review and oversight	IHIMS/PPMD/ MoSD/HD	X	X	X	X	X	X					M and E TWG formed and meets regularly
	Develop inter-departmental and inter-agency co-ordination and support mechanism for integration of information systems following Health Information Exchange (HIE)	IHIMS/PPMD/ HCD/MoSD/Academia	X	X			X	X	X				Co-ordination group formed
	Form a high-level multi-sector steering committee in MoHP for oversight and implementation IHIMS roadmap implementation	IHIMS/PPMD/ HCD	X	X									Steering committee meetings
Improved functional linkages and alignment with different health information systems and data sources	Conduct study of existing routine health information systems (system analysis, standards, feasibility, inter-operability, strengths/ weakness) and implement the recommendations including linkages/ alignment with other health information systems and integration	IHIMS/PPMD	X	X			X	X					Situation report on existing RHIS prepared
	Make repository of all health and population related data from all sources and set co-ordination mechanism for sustainability	IHIMS/PPMD/ HCD/CBS/DoNIDCR	X	X				X					Central data repository
Aggregate e-reporting of health information systems scaled up to all levels	Develop hospital information management and reporting strategy (Outpatient, emergency, inpatient, medico legal, and ICD, birth registry and death registry, Medical Certificate for Cause of Death)	IHIMS/PPMD/ PMD/CD/DoNIDCR	X										Hospital Information Management Strategy developed
	Conduct readiness assessment for scaling up eReporting and implement the recommendation	IHIMS/MoSD	X	X									Readiness assessment report andeReporting

Outputs	Major interventions	Responsibility	Timeframe (2021-2030)										Deliverable
			2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	
	including capacity and support (SoP, mentorship, eTraining, provincial and local level stewardship)												scale up
Inter-operability standards are developed and used in all health information systems (HF registry, NID, Client registry, HR registry, service registry, logistics, app/solutions registry etc) in line with eHealth strategy	Adopt or develop unified codes for HFs, logistics, services, health professional, NID and make inter-operable among all systems	IHIMS/PPMD	X		X	X							HF registry linked to IHIMS
Provincial Health Information Hubs for HIS established and strengthened (staff, units, resources, equipment and infrastructure)	Establish Provincial Information Hub in the MoSD and equip with HR, infrastructure, Terms of Reference and resources required	IHIMS/PPMD/ HCD/MoSD/Federation of municipalities		X	X								Provincial information hubs established
	Develop database for provincial health information hubs and federal database	IHIMS/PPMD/ HCD		X	X								RHIS database for Provincial level developed
	Support to set a health information focal point at the local level with capacity building and infrastructure support	IHIMS/PPMD/ HCD/MoSD/FoM		X	X	X							Local level health information focal point is identified
Resource mobilization mechanism for health information systems set at all levels	Prepare resource mobilization plan at all levels and advocacy for investment (eReporting, EHR, EMR, data quality, data management and use)	IHIMS/PPMD/ MoSD	X	X		X							Resource mobilization plan for RHIS developed
HR Development Plan prepared for health	Prepare HR plan including public health informatics for eReporting, EHR, EMR, data management, at	IHIMS/PPMD/ HCD/Councils	X	X	X	X							HR plan developed

Outputs	Major interventions	Responsibility	Timeframe (2021-2030)										Deliverable
			2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	
information management (Curriculum, training, Continuous Professional Development)	the provincial hubs and local levels												
	Develop eTraining and continuous professional development packages and train through hybrid training (virtual and physical) methods and certification	IHIMS/HCD/MoSD	X	X		X	X						Training and certification package developed
	Support to embed RHIS modules in curriculum of health professionals (education, CPD, certification exams) in collaboration with academia	IHIMS/Medical Education Commission/ Councils/HCD		X	X		X						Curriculum revised with health information modules
Software assessment, audits and upgrading done periodically	Set mechanism to conduct software and technology assessment periodically in view of technological advancement, sufficiency, cost and efficiency	IHIMS/Academia		X		X	X		X		X		Software assessment report
All the health facilities are fully digitalized (EHR, EMR etc.)	Readiness assessment for EHR and EMR for piloting and roll out	IHIMS/Academia		X		X							Readiness assessment report
	Conduct piloting for EHR and EMR and evaluate	IHIMS/PPMD/ MoSD		X	X	X							Piloting evaluation report
	Develop infrastructure, HR capacity and methods for EHR and EMR and roll out	IHIMS/PPMD/ MoSD			X	X	X	X					EHR and EMR implemented
Digital governance framework developed and implemented	Set digital governance framework for federal and provincial levels and implement	IHIMS/PPMD/ HCD/MoSD		X									Digital governance framework implemented
Outcome 2: Better management of data repository and enhanced ownership by citizens													

Outputs	Major interventions	Responsibility	Timeframe (2021-2030)										Deliverable
			2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	
Adequate data security measures taken for health data	Conduct periodic audits for data security and employ higher standard measures	IHIMS/IT MoHP/MoSD	X		X		X		X		X		Audit reports
Single and security enabled data repository and backups maintained	Develop central and provincial data repository for routine information systems and surveys	IHIMS/Academia/MoSD	X	X				X					Central data repository
	Manage security enabled back-ups of data sets and systems along with provincial hubs	IHIMS/Academia/MoSD	X	X				X					Data Security Assessment Report
	Migrate historical data into existing system and add inter-operability features	IHIMS	X	X	X								Old dataset migrated to current system
	Develop Business Continuity Plan for RHIS during emergencies	IHIMS/MoSD	X	X				X					BCP developed
Metadata created for all health data sets	Create and make public metadata and data catalogue for all datasets of information systems and build capacity of information managers on metadata	IHIMS/PPMD/ CBS		X	X			X					Metadata for health datasets
Public concern on health data responded	Develop public domain for gathering and responding public concern and grievances regarding health information including personal information	IHIMS/PPMD		X	X				X				Platform for collecting and responding public concerns
Outcome 3: Ensured right to information and making citizens satisfied of their health needs with better availability, access and utilization of health information products.													

Outputs	Major interventions	Responsibility	Timeframe (2021-2030)										Deliverable
			2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	
People informed of community health situation, health alerts, health service availability, and health service-related offers	Develop public dashboard and integrate in the MoHP and MoSD portals and public display in local levels and their portals, HFs display board	IHIMS/PPMD/ MoSD	X	X	X			X	X				Platforms for data access and view at all levels
	Send health alert and major information to public through SMS	IHIMS/EDCD/ MoSD		X	X			X					Message delivery system established
	Promote health data use in the social audit and public hearings	IHIMS/HCD/MoSD/Federation of municipalities (FoM)		X	X			X	X				Public hearing report
	Support establishing Integrated Disease Surveillance System and sharing relevant information to Public	IHIMS/EDCD/ PPMD/HCD/MoSD		X	X	X							IDSS initiated
Data literacy programs for public initiated	Develop and post manual for using health data, ethical consideration, metadata and data use for general public	IHIMS/PPMD/ MoSD			X	X		X	X				Data literacy assessment report
Digital Health Atlas developed and updated	Develop and update Digital Health Atlas at all levels	IHIMS/IT of MoHP/MoSD	X	X		X		X		X		X	Updated digital health atlas at all levels
	Develop app/digital solution/digital product registry related to health information at all levels and link to eHealth strategy	IHIMS		X	X	X			X			X	Health information related app/solutions registry
Outcome 4: Adequate and accessible health information products for supporting better health service delivery.													

Outputs	Major interventions	Responsibility	Timeframe (2021-2030)										Deliverable
			2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	
Data need for service providers identified, collected, analyzed and made accessible for health service delivery efficiently	Conduct study to identify the RHIS data needed for service providers to deliver services efficiently and make provision for availability	IHIMS/PPMD/ MoSD	X	X			X	X					Assessment report and system redesign
	Make linkage with Population and CRVS data and use on target setting for service delivery	IHIMS/PPMD/ HCD/MoSD/DoNIDCR		X	X		X	X					Updated targets population list
A common platform among MoHP, councils, departments, relevant ministries, and non-state sectors on generation, availability and use of information established	Develop and update integrated portal for health information systems (HMIS, LMIS, HR, Finance, infrastructure, Drug, HF registry, ambulance registry and other relevant) for catering unified information to health service providers including mobile messaging	IHIMS/PPMD/ IT of MoHP/MoSD		X	X	X		X	X			X	Unified portal for data access and use
Outcome 5: Standard, timely, adequate and quality health information for better health policy, plan and program management at all levels.													
Data quality assurance mechanism developed and implemented	Identify core indicators for data quality assessment for federal, province and local levels based on their functions and develop standard tools and method and implement through independent mechanism	IHIMS/PPMD/ MoSD	X				X						DQA tools
	Establish practice of data dissemination along with DQA report linked to each indicator assessed	IHIMS/PPMD/ MoSD			X								DQA report combined with data dissemination
Data need for planners and program managers	Conduct rapid study to identify the RHIS data needed for policy, planning and SDGs monitoring	IHIMS/PPMD/ MoSD	X	X		X			X		X		Assessment report

Outputs	Major interventions	Responsibility	Timeframe (2021-2030)										Deliverable
			2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	
identified, collected, analyzed and made accessible for planning, monitoring and decision making	Promote use of Decision Support System and analyze the RHIS to provide information required using GIS and other tools	IHIMS/PPMD		X	X		X						Decision support system used
Strengthened practice for data use	Develop strategy for improving data use (burden of disease, health situation etc.) by planners, policy makers and program managers	IHIMS/PPMD/ MoSD	X	X			X	X					Data use promotion strategy developed
	Set criteria for performance measures of health service delivery units, governance units and health workers based on the RHIS functions	IHIMS/PPMD/ MoSD	X	X			X			X			Criteria is developed for performance measure
Planning manual consist of data use provisions and complied	Support incorporating mandatory data use and health sector review findings against program and activities in planning	IHIMS/PPMD/ HCD/MoSD	X	X	X								Revised planning manual
	Scale up Public Health Analytic training package for enhanced data use and incorporate in planning exercise	IHIMS/PPMD/ MoSD	X	X	X		X						PHA implementation report
Outcome 6: Adequate and quality health data for research, innovations and meeting mutual interest of stakeholders for partnership													
Linkages with national data agencies and relevant external systems/platforms are established	Support to establish one stop data release mechanism (population, CRVS, HR, food security, education etc.)	IHIMS/PPMD/ CBS/HCD/Do NIDCR/PMD		X	X		X						Population and nutrition related targets list
Health data identified and supplied for measuring progress against UHC and	Develop model for estimating health progress at population level particularly SDGs, NHSS and UHC	IHIMS/PPMD/ NHRC	X	X	X		X			X	X		Estimation model for SDGs indicators

Outputs	Major interventions	Responsibility	Timeframe (2021-2030)										Deliverable
			2021	*2022*	*2023*	*2024*	*2025*	*2026*	*2027*	*2028*	*2029*	*2030*	
SDGs													
Culture of implementation research and operational research on various aspects of health information established	Promote and collaborate for implementation research and operation research to identify the barriers and performance of RHIS	IHIMS/PPMD/ NHRC/MoSD	X	X		X	X		X				Implementation research findings
	Conduct systematic review of information systems at the national, regional and global levels	IHIMS/PPMD/ NHRC		X		X		X		X			Systematic review reports
Build partnership with different levels of government, non-health agencies, research communities, academia and health partners to strengthen the health data	Establish partners forum for resource mobilization and capacity building	IHIMS/PPMD/ HCD	X	X									Partners forum formed
	Set up expert groups to validate country level estimations of health indicators, validation and use	IHIMS/PPMD/ HCD	X	X									Expert group formed and consulted
	Collaborate and take advantage of national, regional and global initiatives for strengthening health and population data	IHIMS/PPMD/ HCD	X	X			X	X			X		Collaborative meeting