# USING HEALTH DATA TO IMPROVE UNIVERSAL HEALTH COVERAGE

THREE CASE STUDIES





This document was produced by the Joint Learning Network for Universal Health Coverage (JLN), an innovative community of practitioners and policymakers from around the world who exchange knowledge and experiences and co-develop practical solutions for implementing universal health coverage (UHC) reforms. The resulting tools provide countries with guidance on designing and implementing efficient, equitable, and sustainable health care systems while contributing to global knowledge on how to achieve UHC. More information is available at www.jointlearningnetwork.org. For inquiries about this document or other JLN activities, please contact the JLN Network Manager Team at jln@msh.org.

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# PREFACE

The Joint Learning Network for Universal Health Coverage (JLN) is an innovative community of practitioners and policymakers from around the world who exchange knowledge and experiences and co-develop practical solutions for implementing universal health coverage (UHC) reforms. The resulting tools provide countries with guidance on designing and implementing efficient, equitable, and sustainable health care systems while contributing to global knowledge on how to achieve UHC.

In 2017, the JLN brought together committed practitioners from 10 countries to form the Data Foundations Collaborative, with a goal of sharing experiences, expertise, and challenges related to using health data to improve UHC. With support from a facilitation team, the group collaboratively produced these case studies, which provide insight into best practices for data governance and data use in three topic areas: chronic disease management, financial management, and use of health insurance claims data.

The case studies were created through in-person and virtual discussions among participants from Ghana, India, Indonesia, Kenya, Malaysia, Nigeria, Peru, the Philippines, South Korea, and Sudan. In October 2017, the participants met in Hanoi, Vietnam, to share experiences with the accessibility and usability of health care data. In April 2018, South Korea hosted a second in-person meeting that showcased its data systems and data use successes. JLN technical facilitators from PATH and Wipro Ltd. collected and synthesized the shared lessons and guidance and combined them with global expertise in health care data governance and use.

The authors gratefully acknowledge the generous funding from the Bill & Melinda Gates Foundation that made the production of this document possible. Other partners contributed valuable technical expertise and created opportunities for global exchange that greatly enriched the content. In particular, the South Korean National Health Insurance Service (NHIS) and Health Insurance Review & Assessment Service (HIRA) hosted a workshop that provided the opportunity to gather content and practical country experience. We also recognize the significant contributions made by facilitating partner Wipro Ltd., especially the technical expertise contributed by Robert Eichler and Sujan Thanjavuru. Special thanks to the JLN participants from Ghana, India, Indonesia, Kenya, Malaysia, Nigeria, Peru, the Philippines, South Korea, and Sudan who graciously shared their knowledge and experiences with one another, demonstrating the value of JLN practitioner-topractitioner learning.



## INTRODUCTION

Globally, health information systems are maturing and providing countries with data to monitor, assess, and improve their health systems and services. As a result, data use has become critical to achieving progress toward universal health coverage (UHC). Countries are using data to better allocate resources, improve health care services, and extend those services to more citizens. Data produced through the implementation of UHC programs can also help support other global and national development priorities.

Information technology (IT) plays a critical role in collecting health care and health financing data in the form of clinical health records, member registries, provider registries, and claims. It is also crucial for turning raw data into actionable information for ministries of health, national health insurance schemes, and other decision-makers, especially as countries apply more advanced data analysis tools and incorporate new sources of data into analysis and decision-making processes. Despite variations between countries in their policies, technologies, and UHC models, common themes are emerging around data systems and data use. Many countries face similar challenges in ensuring data quality, integration, governance, and security, which means they can benefit from sharing best practices and approaches with one another.

This document will be particularly helpful to ministries of health, health purchasers, policymakers, and others who are involved in implementing UHC or interested in using data to support health programs.

# The Case Study Topics

The case studies in this document explore data use for chronic disease management, data use for financial management, and use of claims data to improve the health system. The Data Foundations Collaborative identified these topics as key areas of interest that can also showcase a range of ways to use health data. The topic areas also align with the three main dimensions of UHC reform: improving services, expanding access, and reducing costs. (See Figure 1.)

### FIGURE 1 Data Use to Support Universal Health Coverage



The case studies reflect lessons shared among members of the Data Foundations Collaborative during a workshop in South Korea in April 2018. The experiences of the Republic of Korea (hereafter referred to as South Korea) are central to all three case studies. Since 1977, South Korea has made significant changes to its health care system, including implementing data governance, management, and use practices throughout its UHC service delivery. This rapid expansion and innovation has resulted in many challenges and opportunities that can be instructive to the global community. Throughout this document, the South Korea system and its experience in implementing data use for UHC will be examined and used as the central reference model. Other country examples will highlight common challenges and other potential uses of health care data.

### **Case Study Topics**

CASE STUDY 01. USING HEALTH DATA FOR CHRONIC DISEASE MANAGEMENT This case study examines how national health programs have used data to identify populations at risk of chronic disease, shape new care models, reduce care variation, and improve outcomes using evidence-based treatment.	
CASE STUDY 02. USING DATA TO IMPROVE FINANCIAL MANAGEMENT This case study examines how data are used in financial management of health programs. It provides examples of different financial structures and how countries apply data to budgeting, financial management, and risk analysis.	
CASE STUDY 03. USING CLAIMS DATA TO IMPROVE HEALTH OUTCOMES This case study examines ways to use claims data to improve operational efficiency and service delivery and understand the cost of those services.	

# South Korea's Health Care System

Every South Korean, irrespective of income, has access to health services under the National Health Insurance (NHI) program, the overarching national health system. South Korea's Ministry of Health and Welfare sets health insurance policy and supervises the operation of NHI. Health providers submit claims to the Health Insurance Review & Assessment Service (HIRA), which assesses the claims and sends the results to the National Health Insurance Service (NHIS), the public insurer. The NHIS then pays providers. Under this structure, HIRA is responsible for listing and pricing the benefit services (known as *benefit list management*) and managing health care expenditures. The NHIS is responsible for paying insurance benefits, collecting and pooling funds, managing enrollment eligibility, levying and collecting contributions, and managing NHI benefits payments. It is also responsible for implementing disease prevention projects to help maintain and improve the health of enrollees and their dependents. These services work in tandem to support health care delivery. (See Figure 2.)



#### FIGURE 2 The Structure of South Korea's Health Care System

In South Korea, UHC has contributed to major improvements in health outcomes, including increased life expectancy and a lower infant mortality rate. Life expectancy increased from 64.7 years in 1977 to 82.2 years in 2016; during the same period, the infant mortality rate fell from 32 deaths per 1,000 live births in 1977 to three deaths per 1,000 live births in 2016.

Two key factors enabled the country to achieve UHC: relatively advanced socioeconomic status, including rapid economic growth over the past 70 years, and strategic policies driven by strong political will. One strategic policy was to adopt an incremental approach to coverage expansion, which factored in the ability of insured individuals to pay and the NHIS's administrative capacity to manage expanded coverage.

South Korea has gradually introduced multiple health insurance funds. In 1977, the Social Health Insurance (SHI) program (the predecessor of the NHI program) was launched for workers in corporations with 500 or more employees. In 1979, coverage was expanded to workers in companies with more than 300 employees, followed by gradual expansion to workers in even smaller companies. After the conclusion of several pilot projects for informal-sector workers, the informal sector in rural areas joined SHI in 1988. In 1989, self-employed workers in urban areas were added, marking the achievement of UHC.

As of 2016, the NHIS covered 62.6% of the country's total health care expenditure. The remaining 37.4% was covered by

out-of-pocket payments for uncovered items and copayments for covered items. This coverage rate by the public insurer was lower than the average for Organisation for Economic Co-operation and Development (OECD) member countries due to the copayments and out-of-pocket payments.

Copayments were implemented to improve efficiency in the use of health care services. To discourage patients from unnecessarily seeking care from tertiary hospitals (hospitals that provide specialized care), the copayment rate differs according to the type of facility. For outpatient treatment, the copayment is 30% for clinics, 40% for hospitals, 50% for general hospitals, and 60% for tertiary hospitals. At the same time, out-of-pocket payments are relatively high because many services are not included in the NHI program. These services have been deemed by the Ministry of Health and Welfare as not justified in terms of cost-effectiveness, alternative options, clinical effectiveness, or appropriateness.

The South Korean government is working to expand the cost coverage of NHI. In 2017, President Moon Jae-in announced a new policy, known as Moon Care, to increase the cost coverage rate to 70% during his administration. The policy calls for first introducing a "preliminary payment system" to cover medically necessary services that are not yet covered by NHI. Coverage will then expand to include major items that are currently not covered, such as elective treatment, upgraded hospital rooms, and nursing. Finally, a copayment ceiling system for vulnerable groups and support for catastrophic health expenditures will be instituted.



#### CASE STUDY 01.

# USING HEALTH DATA FOR CHRONIC DISEASE MANAGEMENT



Chronic diseases include long-lasting conditions such as diabetes, heart disease, and cancer that can generally be controlled but not cured. People living with chronic diseases often must manage daily symptoms that affect their quality of life, and many experience acute health problems and complications that can shorten their life expectancy. Often referred to as noncommunicable diseases (NCDs), chronic diseases are the main cause of death around the world, killing 41 million people annually.

National health programs have a critical opportunity to use population health data to identify people at risk of chronic diseases, shape new care models, reduce care variation, and improve outcomes using evidence-based treatment. This case study discusses approaches that various countries have used in tracking chronic care outcomes over time, including the social determinants of health.

### Using Data to Improve Chronic Disease Management in South Korea

Chronic diseases are a major issue in South Korea as well as globally, and the incidence of chronic diseases is continuously growing due to a rapidly aging population. As of 2017, almost one in four deaths in South Korea was due to cardiovascular or cerebrovascular diseases or diabetes. The number of patients suffering from hypertension was nearly 5 million in 2009 and 6 million in 2016, according to NHIS statistics. About 1,908,000 patients had diabetes in 2009; that number rose to 2,704,000 in 2016. This continuous growth in the number of chronic disease patients poses a severe financial threat to the NHIS, which spent US\$19 billion (19.4 trillion KRW) in 2014 on chronic disease care, accounting for 35% of total medical expenditure.

To tackle this problem, the NHIS is implementing a systematic and comprehensive approach to using its own health data.

### The National Health Screening Program

South Korea has had a national health screening program since 1980 and is the only country that provides screening services for the entire population from birth to death. The available screening services depend on the life stage of the individual and can include general health screening, cancer screening, infant health screening, and juvenile health screening (for students and for out-of-school juveniles). Student health screening is administered by the Ministry of Education, while the other screening services are administered by the NHIS.



General health screening for adults and the elderly is conducted every two years and every year for blue-collar workers; its main goal is to detect chronic diseases so they can be treated. The cost is fully covered by the NHIS, and the annual budget for general screening services as of the end of 2016 was about US\$1.4 billion. The elements of the general screening—such as body measurement, lipids, blood sugar, hemoglobin, chest X-ray, hepatitis B, and bone density—are selected based on principles that govern the national health screening program. Individuals can be informed of the results by mail and can view five years of their screening data on a highly secure website administered by the NHIS, using an authentication certificate assigned to them. Data collected from health screenings are used for follow-up care.

## The Health Screening Follow-up Program

The national health screening follow-up program, introduced in May 2004, serves patients who are diagnosed with abnormal cholesterol levels, obesity, hypertension, or prediabetes. The program has two elements: metabolic syndrome management and patient group management.

Those diagnosed with metabolic syndrome (which typically can include high blood pressure, high blood sugar, abnormal cholesterol levels, and excess body fat around the waist) are managed in two groups: the high-risk group and the precaution group. The high-risk group includes patients whose health screening shows more than three risk factors for metabolic syndrome. Individuals exhibiting one or two risk factors are placed in the precaution group. NHIS branch offices provide customized telephone counseling and health information based on the risk factors. Health promotion centers operated by the NHIS also offer services such as medical and nutritional counseling, fitness tests, and exercise guides.

New patients and those whose high blood pressure or diabetes was not treated within one year of their health screening are part of a patient group that receives follow-up care based on topics that change every month as well as information (both online and offline) on managing hypertension and diabetes. Patients have the option to make use of a blood pressure manometer and blood glucose device for free for up to eight weeks.

Both sections of the health screening follow-up program use patients' medical history, health screening data, and insurance eligibility from the NHIS database. Figure 3 shows examples of data recorded during follow-up care.

### FIGURE 3 Examples of Data Extracted for Follow-up Care

#### MEDICAL HISTORY

#### **Diagnosis Codes**

- → 110 (essential hypertension)
- → E11 (Non-insulindependent diabetes)

#### **Prescription History**

- → Patients with hypertension and diabetes
- → Patients with access to medicine less than 80% of the time

### HEALTH SCREENINGS

#### **Screening Results**

- → Blood pressure: 140/90 and above
- → Blood sugar: 126mg/dL and above

#### ELIGIBILITY

#### **Patient Information**

- → Address, contact number
- → Insurance eligibility status

# Accomplishments and Challenges

Health screenings and follow-up care have played important roles in changing South Korea's health insurance model from one based on disease treatment to one focused on prevention. Researchers have found that patients who received health screenings had a 42% lower rate of death from cardiovascular or cerebrovascular disease than those who did not, as well as an 18% lower rate of disease occurrence. Treatment costs for those who did not receive screenings were twice as high as for those who were screened.

The system for health screening and chronic disease management has undergone significant evolution, from a manual system in the 1990s that used handwritten reports to a disk-based system in 2000 to online claim submissions in 2007 to a real-time system in 2012 that uses a web portal for all reporting and claims processing. Hospitals are now connected to the NHIS system, allowing them to retrieve data from it directly. Using this system, the NHIS can collect health data based on the screening results and effectively manage chronic diseases through its follow-up care services. The five most recent years of health screening results are accessible online to each patient, and each NHIS branch uses the database to track follow-up care. (See Figure 4.)

South Korea still has a long way to go in improving service quality in the health screening system and managing chronic diseases, however. Integrating health screening data from private institutions would help with improving and customizing health care services. Citizens would be able to use the platform to predict their future health conditions and manage their chronic diseases more effectively.

#### FIGURE 4 NHIS Follow-up Care System



# **OTHER COUNTRY EXPERIENCES**

In addition to South Korea, many of the other countries in the collaborative have implemented programs that use data to improve chronic disease management. Some highlights are provided in this section.

#### KENYA: IMPROVING CHRONIC DISEASE REPORTING

Collecting data on chronic diseases has been a challenge for Kenya because the data have not been well integrated into national health surveys or the national reporting system. The country has used few indicators for chronic diseases because its focus has been on communicable diseases and maternal and child health. With chronic diseases increasing in Kenya, the country is working to strengthen reporting mechanisms so it can collect quality data to support interventions.

In 2015, Kenya carried out a STEPS survey to assess the burden of chronic diseases and their risk factors, and the data have informed planning for interventions. New indicators have been proposed, and a subset of them will be incorporated into the national reporting system, DHIS2, for routine monitoring. Kenya is also planning to include a subset of indicators for chronic diseases in most health surveys, including the demographic health survey and those targeting communicable diseases (including HIV, malaria, and tuberculosis, which receive substantial funding support).

#### INDONESIA: THE PROLANIS PROGRAM

Indonesia's national health insurance scheme, Badan Penyelenggara Jaminan Sosial (BPJS), has initiated a program called Prolanis for people who suffer from chronic diseases such as hypertension and diabetes. It aims to improve their quality of life, monitor their health status, and prevent complications. As an integrated system, it involves the patient, BPJS, family doctors in government-run community health clinics and primary health care (PHC) clinics, pharmacies, laboratories, and hospitals.



BPJS identifies and selects screened patients through the P-care information system and offers them the opportunity to join the Prolanis program. If they accept, BPJS verifies their data, registers them, and gives them monitoring guidelines. Patients see a provider for an intake exam that includes lab tests, and results from this visit and future visits are reported to BPJS. The data sent to BPJS include the number of visits, the patient's mobile phone number (for electronic reminders), the number of referrals and back referrals (PHC-hospital-PHC), and the number of home visits for patients who do not follow up, have substandard blood sugar, or have uncontrolled blood pressure for three consecutive months.

Prolanis is a vertically integrated system. If a patient needs more advanced treatment, the primary care provider makes a referral to a secondary health facility such as a hospital. After discharge from the hospital, the patient is sent back to the original provider for ongoing care and monitoring. The patient might be referred back to the hospital for certain lab tests such as diabetes tests.

The data collected by the system, including numbers of visits, referrals, and back referrals, are also helpful in measuring the performance of BPJS-contracted primary care.

## Other Examples of Data Use for Chronic Disease Screening Programs

Chronic disease screening programs provide a useful source of data in many countries. The following examples describe ways that countries are using such data to identify at-risk populations or otherwise address chronic disease.

- Ghana uses national population statistics and aggregated census data, segmented by age, to identify people at risk of chronic diseases. The NHIS promotes preventive care through media campaigns, but its budget is limited. National health insurance is meant to cover everyone and enrollment is mandated, but in reality only 40% of the population is covered because of resource limitations.
- The Philippines has an intervention program for chronic diseases that has adapted the World Health Organization's Package of Essential Noncommunicable Disease Interventions (WHO PEN), in line with its commitment to contribute to the global target of reducing mortality due to NCDs by 25% by 2025. The Philippine Package of Essential Noncommunicable Disease Interventions (Phil PEN) Protocol on the Integrated Management of Hypertension and Diabetes is used in all PHC facilities in the country. Screenings are conducted at the PHC level and are managed by community health workers. The screenings include hypertension and diabetes and are free for those age 40 and older and those with a family history of obesity or alcoholism. The referral structure is based on the risk level identified at the screening. In 2016, the Ministry of Health mandated that all rural health centers create a registry of all hypertensive and diabetic patients to closely monitor their health and the medication that are provided to them.
- Public health care in Malaysia is financed through general taxation and public revenues. The government subsidizes 98% of services delivered in public health facilities, which ensures access to health care for all citizens. The revenue earned from service fees represents only 2% to 3% of total MOH expenditure on health. The MOH conducts a regular National Health and Morbidity Survey (NHMS), which collects community-based data on disease patterns, service utilization, and health expenditure. Malaysia's Sistem Maklumat Rawatan Pelanggan (SMRP), formerly known as the Medical Care Information System (MCIS), collects information on individual visits and overall attendance at health facilities. The system was introduced in 1980 in one state and then expanded nationwide in phases to public and private hospitals. Analysis of SMRP data supports health service planning and management, especially for chronic diseases. Data are collected from government health clinics mainly through manual forms, however; only about 8% of public facilities use the electronic medical records system. An update to that system is currently being piloted and will be rolled out in phases to all 1,063 government health clinics. It will provide comprehensive patient data from the primary health care system and will be the data source for all registries and data warehouses.
  - Malaysia's health screening efforts include periodic employer-mandated health screenings as well as voluntary visits to primary care facilities. Every school has an affiliated district health officer or health clinic that implements health programs, including basic physical exams, screenings, and immunizations. Adolescents receive health screenings through school health programs. Data from all of these transactions are collected in the Malaysian Health Data Warehouse (MyHDW).
- Indonesia has several programs that increase awareness of healthy living options. The capital city of Jakarta has a household screening and visitation program, and some provinces have private health care facilities that screen for chronic disease risk factors. The Healthy Indonesia Programme with Family Approach (Program Indonesia Sehat Dengan Pendekatan Keluarga) is a national program that provides home visits to identify health risks. Its coverage target was 30% in 2017 and 100% in 2018. Primary care facilities are part of a national screening program, with data from the screenings remaining with the facility. Indonesia conducts a survey on chronic diseases every three years, using 12 indicators related to hypertension and tuberculosis; the data are collected by PHC providers. The survey will soon expand to include all chronic diseases. Hospitals conduct monthly monitoring and reporting of chronic diseases.

# CHALLENGES AND SOLUTIONS

Table 1 summarizes challenges and solutions related to data use for chronic disease management that countries in the Data Foundations Collaborative shared with one another, organized by categories of data governance and data use.

TABLE 1	Using Health Data fo	r Chronic Disease	Management:	Challenges and Solutions
				3

CATEGORY	Challenges 🔿 🔶	SOLUTIONS ->>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>>
Data Collection	<ul> <li>Geographic barriers in some regions of the country.</li> <li>Not all data sources are electronic. For example, in Malaysia only 16 of 144 hospitals are using electronic medical records. Another 20 use electronic systems for ordering. The rest rely on paper-based systems.</li> <li>Infrequent data collection; surveys are self-reported.</li> <li>Underreporting and limited screening of chronic diseases.</li> <li>Lack of technological infrastructure.</li> <li>Limited data set: The NHIS does not allow tracking of disease patterns for planning purposes.</li> <li>Only claims-related data are collected.</li> <li>Routine system data are lacking. A demographic health survey every five years is not frequent enough for sound analysis. Data are collected for only one or two chronic disease indicators.</li> </ul>	<ul> <li>Digitize collection systems. (Indonesia)</li> <li>Implement a pilot project to deploy mobile tablets with GPS for real-time data collection. (Ghana)</li> <li>Ensure that electronic medical record systems have integrated modules for claims. (Ghana)</li> <li>Introduce an incentive structure to promote data collection and sharing of information. (Malaysia, Nigeria, South Korea)</li> <li>Deploy a secondary data collection system online for individual visits and overall attendance at health facilities. (Malaysia)</li> <li>Use hospital-based population data and disease-based patient registries to inform performance and process indicators. (Malaysia)</li> <li>Respond to emerging trends and reasses health programs using data projections and estimates based on baseline demographic and social health determinants collected every four years. (Malaysia)</li> </ul>
Governance and Policy	<ul> <li>Data sharing between agencies (especially between the public and private sectors) is limited due to patient privacy and confidentiality concerns. Better guidelines and governance processes are needed.</li> <li>Lack of clear data privacy guidelines, leading to limited data sharing.</li> <li>No mandate for data sharing between doctors and the NHIS.</li> <li>Lack of data sharing between national agencies and institutions.</li> <li>The NHIS has all population data, while the Ministry of Education has data on youth health; integration is technically possible but is hindered by policy.</li> <li>No direct financial incentives for data collection. Data collection is for managerial and reporting purposes.</li> <li>Lack of a prevention program and limited prevention and/or screening services.</li> <li>No consistent governance model for systemwide health decision-making.</li> <li>New data privacy law poses significant challenge to data collection.</li> </ul>	<ul> <li>Major investment in next-generation information technology (100,000 billion KRW, or US\$88.5 billion). (South Korea)</li> <li>Improve data privacy by resolving political issues. (Philippines, South Korea)</li> <li>Negotiate sharing of more than claims data between national agencies (including ministries of finance, education, and e-government and bureaus of statistics, local administration, and regulation) and medical providers. (South Korea)</li> <li>Add chronic disease screening as a benefit in the national health insurance system. (Kenya)</li> <li>Add an incentive structure to promote the use of appropriate-level facilities. (South Korea)</li> <li>Enact a policy to include additional stakeholders in data sharing. (South Korea)</li> <li>Deepen engagement with the private sector to incorporate private-sector health data. (Ghana, Peru)</li> <li>Implement open data initiatives aimed at increasing economic growth through data-driven innovation and greater government transparency. Encourage interagency and public sharing of data. (Malaysia)</li> <li>Clarify confidentiality policies governing medical information. (Philippines)</li> </ul>

CATEGORY	Challenges 🔶 🔶	Solutions 🔸
Data Aggregation	<ul> <li>Data are mainly collective records of visits, not individual patient records.</li> <li>Systems are paper based and transferred to electronic form.</li> <li>The NHIS and MOH have different data systems and therefore limited access to one another's data.</li> <li>Data systems are fragmented, and data are difficult to monitor and evaluate.</li> <li>DHIS2 central database system is used only by public facilities; 80% of facilities in the country are private.</li> </ul>	<ul> <li>Use DHIS2 to harmonize data from private and public facilities. (Ghana, Nigeria)</li> <li>The MOH is working on a framework for interoperability of data systems. (Sudan)</li> <li>Use a unique ID system to link data across collection systems. (Indonesia)</li> <li>Use one system for entry of patient data. (Indonesia)</li> <li>Build a data warehouse with all needed variables. (Malaysia)</li> <li>Introduce incentives for private facilities to use DHIS2 and revoke accreditation if they do not use it. (Nigeria)</li> <li>Integrate data via online reporting by all PHC facilities using the online system. (Indonesia)</li> <li>Appoint a senior officer to manage business relationships between providers and the NHIA for data management. (Ghana)</li> </ul>
Data Quality	<ul> <li>Cleaning data is time consuming because the electronic system has not evolved to reflect the shift from fee-for-service payment to capital cost payment, due to cost limitations.</li> <li>Incomplete data sets.</li> <li>Data are aggregated but need cleaning.</li> <li>Diagnoses and diagnosis coding are sometimes inaccurate.</li> <li>Quality of screening data differs between institutions.</li> </ul>	<ul> <li>Prioritize and budget for IT system improvements. (South Korea)</li> <li>Rank and revise data indicators to collect better information. (Kenya, Philippines)</li> <li>Standardize screening data and results and coding management. (South Korea)</li> <li>Implement an automated system and metadata standardization. (Indonesia)</li> <li>Use technology from locally based, government- funded ICT applied research and development centers, along with technical input from local or foreign consultants, to develop ICT systems that conform to local and international standards. (Malaysia)</li> <li>Conduct an annual coding error rate study to complement ongoing retraining in data collection. (Malaysia)</li> </ul>
Data Integration, Transferability, and Access	<ul> <li>Decentralized disease-based patient registry systems lack interoperability and integration.</li> <li>Different levels of data (community, district, etc.) not integrated.</li> <li>Lack of data transferability.</li> <li>Health facility and claims data are not integrated.</li> <li>Fragmented data sources and interoperability challenges.</li> </ul>	<ul> <li>Address data privacy and data-sharing challenges. (Philippines)</li> <li>Implement an IT system to process data for analysis and evaluation, and ensure ongoing development to make it interoperable. (Philippines)</li> </ul>

#### TABLE 1, continued

Category	CHALLENGES 🔶 🔶	Solutions
System Integration and Interoperability	<ul> <li>Poor connectivity and technology infrastructure for use of DHIMS2, which requires internet connectivity.</li> <li>Poor integration of data sources.</li> <li>Application interface challenges.</li> <li>Difficulty transferring data to DHIS2.</li> <li>Private providers are not yet integrated into the national software system.</li> </ul>	<ul> <li>Install fiber optic cable to all district administrators and hospitals. (Ghana)</li> <li>Aggregate data in one hub. (Indonesia)</li> <li>Aggregate and integrate data from all levels into one system. (Multiple countries)</li> <li>Collect all data in DHIS2. (Ghana)</li> <li>Implement policies to support interoperability of data systems. (Ghana)</li> <li>Require private facilities to submit data under the Private Health Care Facility and Services Act of 1998. These data include a limited set of indicators and exclude some personally identifiable information. (Malaysia)</li> <li>Implement the Malaysian Health Data Warehouse, a near-real-time system that receives disaggregated data at 24-hour intervals. The data warehouse system integrates disparate databases and harmonizes them for analysis and to provide users with business intelligence tools and analytics for visualization. (Malaysia)</li> <li>Implement Health Informatics Standards like ICD-10 nationwide. Have an MOH-led referral center manage these standards and provide ICD-10 certification. (Malaysia)</li> </ul>
Analytics and Visualization	<ul> <li>No analytics dashboard.</li> <li>Lack of analytical capabilities.</li> <li>Data from private providers (30% of all providers) not available for analysis.</li> <li>Data not available in real time. Hospitals use manual registers. Disaggregated data are not available. Analysis is difficult and sometimes misleading. Claims data are collected in a separate data system.</li> <li>Different sources of data can lead to different interpretations, which can complicate decision-making.</li> <li>Inefficient data collection and need for more people trained in data analytics.</li> </ul>	<ul> <li>Train more staff in data analytics. (Philippines)</li> <li>Move to real-time, disaggregated data, including patient profiles (age, sex) to aid in planning. (Ghana)</li> <li>Strengthen the capacity-building program for data analysis in the health sector. (Philippines)</li> </ul>

Lack of health care data can be due to limited care delivery or lack of data collection at the point of care delivery. Either way, countries need policies to enforce data collection and ensure that data collection is built into care delivery processes.

Some countries grapple with challenges in staffing for data collection; others have nascent data collection processes but are not able to fully implement them. Several countries are finding that the design of their UHC-focused national health program affects their ability to join data from disparate sources. For example, a combination of public financing and service delivery for vulnerable populations combined with private financing and services through insurance companies and private providers might make it difficult to aggregate health information and thereby better understand overall population health. Even in places where the private sector is required to collect data on population health, those data are not always transferred to the public system and aggregated with data from public providers.

Other challenges include inconsistency between facilities; data from health screenings staying at the facilities that conduct the screenings or the agency overseeing the facilities; data from regional pilot projects not being shared with the national health insurance scheme; errors in transferring data from a paper-based system to a digital system; and lack of data encryption in data servers. Variability in medical coding is another challenge. In Peru, each statistical office establishes and manages its own set of codes for the same health conditions. The national health insurance has used a mix of coding manuals for several years; sometimes payment codes have been created by adding additional letters or numbers without following a standard methodology. The Ministry of Health recently approved a new coding manual that seeks to address these issues, but it assumes a certain level of computer system capability and equivalences in coding standards. Peru hopes to solve this problem by creating a new information system for all health subsystems in the country.

# **STAGES OF MATURITY**

As the Data Foundations Collaborative synthesized experiences from 10 represented countries in using data to support chronic disease management programs, a pattern of data use characteristics emerged. They grouped the characteristics into a simple maturity model with three stages—early, middle, and mature—to indicate a progression of priorities and activities. (See Table 2.) Countries can use this model to get a sense of their next steps and the associated challenges. As countries progress toward better data collection and management, they will also face decisions about whether to improve the current system or take advantage of their potential to leapfrog to an entirely different system or solution. For example, South Korea could have improved its manual, paper-based system by adding dedicated couriers and implementing scanning systems, but it bypassed hard-copy delivery problems by taking advantage of advances in digital technology—first by using physical disks and then by creating a portal for data collection.

#### TABLE 2 Stages of Maturity in Using Data for Chronic Disease Management

EARLY STAGE	MIDDLE STAGE	MATURE STAGE
<ul> <li>Multiple data systems (e.g., from the MOH and from the national health insurance system) are not connected or integrated.</li> <li>Data from other sources are typically not available for analysis.</li> </ul>	<ul> <li>Surveys to collect chronic disease data are intermittent and have low coverage.</li> <li>All data are combined into a single system.</li> <li>Data standards are implemented and data quality is improved.</li> </ul>	<ul> <li>Screening data and metadata are more standardized.</li> <li>Data privacy and data ownership are issues of public and policy debate.</li> <li>Accessibility of population health data to policymakers, researchers, and other stakeholders supports better analysis of data to shape chronic disease management programs.</li> </ul>

### **KEY RECOMMENDATIONS FROM JLN COUNTRIES**

- » Implement data-sharing agreements among the national payer, the national health insurance scheme, the MOH, and other relevant agencies.
- » Develop and train health workers on one consistent coding standard.
- » Build a common data repository and ensure that systems are set up to push data to the repository.
- » Ensure that separate vertical health programs (diabetes screening, cancer treatment, etc.) use the same set of data management norms.

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#### CASE STUDY 02.

# USING DATA TO IMPROVE FINANCIAL MANAGEMENT



Well-intentioned health programs—including UHC efforts that focus on preventive care throughout the stages of life—are at risk of collapse if they do not have rigorous processes for collecting revenue and managing expenses. Even if the overall budget is balanced within a given period, issues of cash flow can jeopardize care delivery.

Many countries also struggle with problems of financial data integrity, such as payment data from health facilities differing from data submitted for claims, incompatible technical formats and diagnostic coding, and irreconcilable values from multiple sources because of differing data definitions and taxonomy. Some financial management challenges are not technical or operational. Budgets can prove inadequate because of continually rising costs due to new procedures and an expanding population base.

This case study examines requirements for sound financial management and discusses how using timely and accurate data can improve the quality and stability of a health program.

### Using Data for Financial Management of the Health System in South Korea

Since its introduction in 1977, South Korea's National Health Insurance (NHI) program has dramatically increased its annual health care expenditure from US\$4.5 million (51 billion KRW) in 1977 to US\$47 billion (52 trillion KRW) in 2016. The system has made significant progress in terms of health financing, but this progress was complicated by the Asian Financial Crisis of 1997. For example, when NHI integrated multiple funding sources in 2000, the system suffered deficits due to dramatic increases in expenditures, the loss of some vulnerable funds, and other setbacks. As a result, the NHIS, the single insurer under the NHI program, began putting greater emphasis on financial management in the NHI system.

Demographic changes, slow economic growth, and an increase in chronic diseases are affecting the financial sustainability of the NHI program. For example, a low fertility rate and an aging population over the past decade are seen as contributing to health care expenditures. It is therefore important that the NHIS manage the NHI budget in a sustainable way.

### Financial Management of the NHI Program

The finances of the NHI program are managed on a fiscalyear basis because coverage under the program is considered "short-term insurance." Technically, financial management of the NHIS system has three phases. First, the NHIS checks revenues and expenditures on a daily basis. Second, it analyzes financial risk factors on a monthly basis. Finally, it carries out budget projections on a yearly basis. (See Figure 5.)

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The NHI budget is determined annually, based on projected expenditures and income. The government sets the fee schedule and benefits coverage, and then it determines any increases in premiums and government subsidies.

The NHIS sends monthly bills to those who are responsible for paying them, including employers and heads of households. Bills can be paid using various methods, such as bank transfers and online and mobile payments. The NHIS needs access to all account information and receives related data from other government bodies, such as the National Tax Service and the Ministry of the Interior and Safety.

The NHIS manages NHI expenditures using NHI data on benefits coverage, claims reviews, payments, health screenings, long-term care insurance, and so forth. After a patient uses medical services, the health care provider submits a claim to the Health Insurance Review & Assessment Service (HIRA), which reviews the claim and informs the NHIS of the results.

If the claim has no problems, the NHIS pays the provider. The NHIS thus manages claims data as well as payment data. (In addition, as explained in the previous case study, the NHIS administers NHI health screening programs for all insured individuals and thus receives and manages all health screening data. It also analyzes the data to contribute to the development of evidence-based policies.)

As the country's single insurer, the NHIS must manage all health income and expenditures. Until 2005, the 1,600 bank accounts related to NHI financing depended almost entirely on manual work processes, which led to numerous human errors. NHIS staff also had to visit banks in person to verify that premiums and benefits payments were paid. This hampered customer service and the ability to manage funds. To improve this offline process, the country established the Health Insurance Bank (HI-BANK) System.

HI-BANK is an IT-based financial management system that links the NHIS business and accounting systems (which contain data on premiums, health screening, business operations, and so forth) to financial institutions such as banks, securities companies, and credit card companies via encrypted connections in real time. (See Figure 6.) The system even connects to the accounting systems of four major types of social insurance: pension, health insurance, unemployment insurance, and industrial accident insurance. Every department at the NHIS and every NHIS branch office can access HI-BANK.

#### FIGURE 6 The HI-BANK Financial Management System



### A Portal for Financial Risk Management

One of the most powerful features of the integrated IT system is its financial risk management system, which enables continuous monitoring of premium contributions and benefits expenditures and allows adjustments to contribution rates to correspond with changing health expenditures. Figure 7 shows the customized web portal where NHIS staff can produce daily or monthly reports with data visualizations, using data from the NHIS data warehouse.

The NHIS uses six risk indicators that fall into two categories: internal risks and external risks. Financial risk managers can also create custom risk indicators. The portal uses yellow, green, and red color coding to indicate risk levels. The monitoring system is powered by HI-BANK's real-time transaction data warehouse. In cases where financial risks are anticipated, the NHIS and related government bodies can counteract the risk according to predetermined policies and procedures.

One example of South Korea's successful risk management occurred during the global MERS viral outbreak in 2015, which led to a dramatic increase in NHI medical claims to treat those affected. Many people avoided medical facilities due to fears of becoming infected. In response, the Ministry of Health and Welfare offered advance payments to smaller facilities to prevent them from going bankrupt. Financial managers also requested additional government subsidies based on real-time data.

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0 Alar	m System of Financ	ial Risk								🖻 조회 🔊 엑셀
Year	2016년도	~						Financial	Risk	Category
								(Leger	nd ;	000
Level	KRI(unit)	August		September		October		November		December
Total	Current balance (KRW 100M)	∆1,885	0	354	0	305	0	∆2,141	0	372
	Solvency margin ratio (%)	38.3	۲	38.4	0	38.4	0	38	0	38.1
Market	%VaR (%)	0.0842	۲	0.0977	۲	0.1088	۲	0.1709	0	0.1842
Income	Growth of the insured (%)	22,551,530	0	22,584,139	0	22,619,251	0	22,694,476	0	22,819,004
	Collection rate (%)	98.9	۲	100.3	۲	97.4	0	100.6	۲	99.7
	Monthly salary growth (%)	3,291,777	0	3,312,484	0	3,273,576	0	3,247,277	0	3,278,771
Expanse	Growth of insurance benefit per capita	83,065	0	84,240	0	76,660	۲	84,207	0	87,585
	Growth of hospitalization and visit days (%)	123,236,088	١	125,556,643	0	117,002,481	١	128, 477, 184	0	132,738,171

# **OTHER COUNTRY EXPERIENCES**

In addition to South Korea, many of the other countries in the collaborative have implemented programs that use data for financial management. Some highlights are provided in this section.

#### INDONESIA: BUDGETING FOR HEALTH

Funding for the health budget in Indonesia comes from premiums (shared by individuals and employers) and government subsidies for the poor (financed through taxes). The government evaluates expenses and premium sources every two years.

The Ministry of Health proposes a budget to subsidize premiums for the poor and transfers the funds to BPJS, the national health insurance scheme. Projections

are based on the previous year's budget and an estimate of the poor population. By 2019, the ministry will subsidize premiums for all Indonesians. BPJS presents its budget to the ministry, which grants approval and supervises implementation. The ministry acts as the voice of the people, evaluating any proposal by BPJS to increase premiums.

Budget challenges arise from lack of integration of health insurance data and Ministry of Health data. In the case of a budget deficit for health, the president must ask the Ministry of Finance to cover the shortfall to cover payments to health providers. Lack of data on actual expenses can lead to such shortfalls. Better information on previous costs, not just the previous budget, would help with more accurately predicting, planning for, and meeting expenses.



#### MALAYSIA: GOVERNMENT-SUBSIDIZED HEALTH CARE

Malaysia's health care system includes both public and private health care services. Public facilities provide services with only nominal user charges, providing strong financial risk protection for the poor. The country does not have a national health insurance system; however, people can buy private insurance to access additional services offered by the private sector.

Public health facilities receive a fixed annual budget. If they run a deficit, they can request additional funding through the midterm budget review. If they run a surplus, they must return it to the central government for budget reallocation. Budget allocation is linked to performance indicators and targets. Performance is measured based on predefined outcomes for planned programs and activities. The system does not penalize underperforming health facilities, but it uses performance data to inform budget allocation and planning.

Since Malaysia lacks a claims database to inform health expenditure, it established the Malaysian National Health Account (MNHA) to provide macro-level health expenditure information based on the internationally standardized National Health Accounts methodology. MNHA routinely publishes reports describing key trends in both public- and private-sector spending for health, giving policymakers and others quality information to use in developing evidence-based health policies.

Malaysia's approach does not encourage real-time collection of utilization data to substantiate costs. Self-reporting by public providers is not always timely, so there can be little forewarning when costs are about to exceed budgetary limits.

#### KEYS TO SUCCESSFUL BUDGETING

Successful budgeting requires being able to predict revenue from a variety of sources and to anticipate expenses. It helps to have access to historical information on which to base assumptions and expectations. The most precise data that reflect the costs of rendered care are often claims data collected at the point of service and forwarded to a central hub for reporting and analytics.

Countries that lack reliable utilization-based data often turn to proxy measures such as claims data that provide billing-level detail about services provided. When funding for health programs comes from disparate sources (e.g., taxes, premiums shared by individuals and employers, charitable contributions, and government subsidies), the budgeting process can



be more complicated. A further challenge is the ability to obtain information from private health insurers and providers and combine it with public-sector data.

In many countries, financial data support annual or biannual budget planning but the data are not available in real time or even near-real time. These countries rely on a mix of actual costs, information from public health programs, and population census data to set annual health budgets. An annual budget cycle should ideally be supported by more frequent budget-toactual controls to provide insight into shortfalls and cash flow and identify when to establish reserves to cover temporary and intermediate-term shortfalls.

Kenya and Indonesia have used financial data to design benefits packages, set contribution amounts, and evaluate provider performance. The analyses typically focus initially on cost management before considering outcomes or overall population health improvement.

The countries in the Data Foundations Collaborative use a variety of payment methods, including budgeted payments to providers to cover future costs, capitation, and utilization-based reimbursement. The methods used affect not only the cost of services but also the financial risk to providers, care-seeking behavior among the insured, and health outcomes.

# CHALLENGES AND SOLUTIONS

Table 3 summarizes challenges and solutions related to data use for financial management that countries in the Data Foundations Collaborative shared with one another, organized by category.

### TABLE 3 Using Health Data for Financial Management: Challenges and Solutions

CATEGORY	CHALLENGES	Solutions
Data Collection	<ul> <li>The same data must be entered into two separate systems (Ministry of Health and NHS).</li> <li>The provider payment method (e.g., fee-forservice, case rates, capitation) can effect what data are collected; for example, service level data may not be sent from facilities to the insurer if payment is based on capitation rates.</li> <li>Not all health facilities use electronic medical records. Instead, the MOH deployed a secondary platform to collect data from providers. This system deals with a significant volume of granular data, which requires additional resources for data collection.</li> </ul>	<ul> <li>Build data collection activities into the provision of care or billing system, such as when clinical data are entered into an electronic medical record. (Multiple countries)</li> <li>Implement an efficient IT system at the provider level with a simple data collection tool that can be used on a mobile phone. (Kenya)</li> <li>Deploy a platform system to collect data from providers. (Malaysia)</li> <li>Use a real-time reporting mechanism to send data from providers to the central government. (Philippines)</li> </ul>
Governance and Policy	<ul> <li>Data collection and aggregation are hampered by lack of technology, processes, and enabling policies.</li> </ul>	<ul> <li>The first priority should be to enact the policies— including those that mandate data sharing among health stakeholders—because they provide the foundation for proceeding with the other steps. (Multiple countries)</li> <li>Use clinical pathways and diagnosis-related groups to standardize practice and help with budget projections. (Indonesia)</li> <li>Create a culture of data use among employees. (Philippines)</li> </ul>
Data Aggregation	<ul> <li>Insufficient staff capacity in data analytics.</li> </ul>	<ul> <li>Train sufficient staff in data analytics and using data analytics software. (Multiple countries)</li> </ul>
Data Quality	<ul> <li>Health data should not only be reported to the national level but should also be available to individual practitioners to give them greater insight into their local population and their practice.</li> </ul>	<ul> <li>Develop a health data warehouse to support interoperability and data sharing. Data submission online increases accessibility and coverage in all health facilities with internet access. (Malaysia)</li> <li>Strengthen data harmonization and integration between Ministry of Health data and public health insurer data. (Kenya, Peru, Philippines)</li> </ul>
Data Integration, Transferability, and Access	<ul> <li>Data from multiple sources are difficult to match up during annual benefits review.</li> </ul>	<ul> <li>Improve data integration and reduce duplication. (Indonesia, Philippines)</li> </ul>
System Integration and Interoperability	<ul> <li>National claims data are still collected manually; electronic data coverage is only about 16%.</li> </ul>	<ul> <li>Planned nationwide scale-up of e-claims. (Ghana)</li> <li>Start using software applications (P-care). (Indonesia)</li> <li>Electronic data allow for more frequent and efficient data analytics. (Ghana)</li> </ul>
Analytics and Visualization	<ul> <li>Those who are asked to submit data should be trained so they understand what NHI is, why they have to submit data, and how they can benefit.</li> </ul>	<ul> <li>Hire a consultant to do budget projections. (Sudan)</li> <li>Expand actuarial skills. (Kenya)</li> <li>Implement planned recruitment and capacity building. (Ghana)</li> </ul>
Finance	<ul> <li>Financial management and financial sustainability are a challenge, both in terms of managing funding sources and managing costs.</li> </ul>	<ul> <li>Implement planned recruitment of additional staff and capacity-building trainings on data use. (Sudan)</li> <li>Increase the tariff and contributions rate. (Ghana)</li> </ul>

CATEGORY	Challenges 🔶 🔶	Solutions
Infrastructure	<ul> <li>Some data systems have not been accredited, and some data sources have not been properly vetted.</li> </ul>	<ul> <li>Develop data exchanges-a project that was previously abandoned due to government changes. (Peru)</li> <li>Digitize the financial system and management system and integrate with the Ministry of Finance. (Sudan)</li> <li>A national health insurance scheme is preferable in the long term, but to improve health care delivery in the current context, implement a public-private partnership to increase access to health care by subsidizing services outside of public facilities. (Malaysia)</li> </ul>

## **STAGES OF MATURITY**

While financial systems can vary dramatically in their complexity and scale, the countries in the Data Foundations Collaborative identified some common characteristics and patterns. They grouped the characteristics into a simple maturity model with three stages—early, middle, and mature—to indicate a progression of priorities and activities. (See Table 4.) Countries can use this model to get a sense of their next steps and the associated challenges.

### TABLE 4 Stages of Maturity in Using Data for Financial Management

EARLY STAGE	MIDDLE STAGE	MATURE STAGE
<ul> <li>Budgets are inconsistent or cover only some regions or health areas.</li> <li>Budget information is not available in real time.</li> <li>Census data are used to set costs.</li> <li>Historical financial data are not available.</li> <li>Funding is not aligned-different programs have different funding sources.</li> </ul>	<ul> <li>Some historical cost data are available to inform current year budgets.</li> <li>Funding sources are not streamlined, but they are aligned in focus and purpose.</li> <li>Most public system data are included in a central reporting hub, but not private-sector data.</li> <li>Access to utilization-based data is limited.</li> </ul>	<ul> <li>Real-time, ongoing financial reporting is used and accessible</li> <li>The annual budgeting process is consistent and comprehensive.</li> <li>Claims data and financial data are included in a central processing hub for reporting and analytics.</li> <li>Private and public data are both accessible.</li> <li>Financial data are used for reviewing and adjusting benefits packages, setting premium and revenue targets, selecting provider payment methods, and setting payment rates.</li> </ul>

### **KEY RECOMMENDATIONS FROM JLN COUNTRIES**



- » Ensure that clinical practice standards and data collection/management are aligned.
- » Standardize payment systems and procedures, including with global funders.
- » Improve data visibility and visualization between annual budgeting cycles.
- » Analyze who needs financial data and when, and how data can flow in a loop.
- » Ensure that financial policies keep pace with new standards and technology.
- » Harmonize financial systems across the health sector and train current and future staff.

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CASE STUDY 03.

# USING CLAIMS DATA TO IMPROVE HEALTH OUTCOMES



Insurance claims data can supplement health data collected through health records and routine data collection. Associating financial transactions with claims can lead to higher-quality data, making claims data a rich, standardized source of data on a nation's health system. Claims data can help health care administrators, researchers, and policymakers understand the cost and quality of health care services, detect fraud, identify at-risk patients, and improve patient care.

The availability of claims data is influenced by the national model for health financing (e.g., is there a national payer, are data available from public or private payers, etc.), what services are included in the benefits package, the provider payment methods used, and the digital systems used to capture, transmit, process, and pay claims. Claims data are increasingly being integrated with internal and external data sources to create sets of "big data," which is expanding their potential applications. Sharing this data with users in the public health field, clinical researchers, academics, and industry enables countries to generate greater insights into how to improve health services. This case study examines ways that claims data can be used to support a country's progress toward universal health coverage.

## Using Claims Data to Improve the Health System in South Korea

Since the introduction of South Korea's national health insurance system in 1977, the Health Insurance Review & Assessment Service (HIRA) has played a pivotal role in improving the efficiency and quality of health care services. HIRA's most important functions include reviewing medical claims, assessing health care quality, and supporting the government's policy decisions regarding the medical fee schedule, drug prices, and so forth.

HIRA uses an IT system called the HIRA System to carry out these functions in an integrated manner. (See Figure 8.) It collects more than 1.5 billion units of claims data each year, covering the entire Korean population and all health care providers in the country. HIRA also periodically collects data on staff, facilities, and equipment (which it uses to manage the health care infrastructure); information on the approval of pharmaceuticals, medical equipment, and medical supplies; and information on the distribution of pharmaceuticals. In the HIRA System, these data are interlinked and organized using unique identifiers such as the resident registration number, drug ID, provider ID, and medical supply ID.

HIRA also integrates data from other public organizations, including residence and death data from the Ministry of the Interior and Safety, travelers' entry and departure information from the Ministry of Justice, and data on communicable diseases from the Korea Centers for Disease Control and Prevention (KCDC). Through these linkages, HIRA can detect fraudulent claims made by patients or health care providers that it would not be able to confirm with its own data alone; it also analyzes and predicts various causes of health care expenditure.

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Other public organizations also make use of HIRA's claims data. HIRA shares data with the Korean Red Cross on patients with diseases that can be transmitted through blood transfusions or those who are taking medication that prohibits them from donating blood. Claims data are also used for social welfare and safety. HIRA provides death data from claims forms to the Social Security Information Service so social welfare benefits are not fraudulently obtained after the beneficiary's death, and it provides information to the Korean National Police Agency on missing persons' recent visits to hospitals and clinics to help the police locate them.

# HIRA's Open Healthcare Big Data System

To increase the value and use of its health care data, HIRA is making them available not only to government agencies and health care providers but also to research institutes, the private sector, and the public. As a part of this effort, HIRA launched the Open Healthcare Big Data System (opendata.hira.or.kr) in 2015. (See Figure 9.) It offers three main services:

- **PUBLIC DATA PROVISION SERVICE.** Data are publicly available in the form of data sets, statistical information, and open application programming interface (API) services.
- **BIG DATA ANALYTICS SERVICE.** Raw data analysis is provided onsite at the Healthcare Big Data Center or through a remote system to academia and industry.
- **CUSTOMIZED INFORMATION PROVISION SERVICE.** This portal allows users to search for hospitals that fit their needs; view visualizations of 118 population health indicators (including nontraditional population health indicators on health care resources, pharmaceuticals, medical supplies, and medical devices); and their individual prescription history updated in real time.

Table 5 describes how different types of users are making use of HIRA's data.



### TABLE 5 HIRA Data Use by Type of User

Type of User	Use Examples
Health administration consulting firms	Using information on health care resources and geographic information system-based health data to make recommendations for resource allocation
Health care IT development firms	Using data on prescriptions, drug inventory, and artificial intelligence-based health care demand forecasts to develop applications for payments at pharmacies
Health care industry	Using data to inform development of new drugs, medical devices, medical supplies, and products connected to the Internet of Things
Policymakers	Using data to develop policies on expanding health insurance coverage, improving efficiency of health care services, improving patient safety, and so forth
Clinical researchers	Using data to support development of clinical guidelines in each specialty, decision-making in the clinical setting, and health care administration
Academic researchers	Analyzing data to determine the effectiveness of medical technologies, support research and development, and study health care trends
The public	Viewing data on population health trends; using data to establish new businesses

One valuable use of HIRA's data is to facilitate efficient research and development (R&D). Claims data can be quickly analyzed at low cost because the data cover the entire population and selection bias is minimal. Moreover, researchers can make comparisons with comparator drugs, which is difficult to do in clinical trials, as well as conduct long-term tracking of medications for chronic diseases, including the incidence of complications. HIRA has arrangements with 10 research-oriented hospitals to exchange information and collaborate on research.

In 2016, HIRA supported a research project that analyzed the performance of health care services related to 21 diseases, including neurologic disorders. Understanding this type of medical data requires specialized knowledge, however, so HIRA conducts joint research through a program called HIRA Big Data Joint Research. HIRA selects projects and partners through a competitive selection process. In 2016, HIRA collaborated on nine joint research projects, including "Assessing the Risk of Dementia Posed by General Anesthesia," with nine research organizations. In the private sector, pharmaceutical and medical supply companies use HIRA claims data on drug and medical supply use in their R&D efforts. One mobile app development company developed a hospital finder app based on HIRA's public data and GPS. Features include "Hospital/pharmacy search by location" and "Hospital search by theme." Users can find information tailored to their needs, such as clinics with female gynecologists, hospitals that specialize in treating burn injuries, and hospitals that are open after business hours. The app has been downloaded 2.3 million times to date.

South Korean citizens can view information on population health trends, including visualizations, in the Open Healthcare Big Data System. Health care providers can learn about the establishment and closure of hospitals and pharmacies by type and region, view patient numbers and medical fees by region and age, and view other data that can be helpful in hospital administration. Table 6 shows the data that are publicly available through the HIRA system. Figure 10 shows examples of data visualization using this data.

### TABLE 6 Publicly Available Data Through the HIRA System

Category	Τύρε ος Δατά
Health resource statistics	Staff, facilities, and equipment of medical providers
Pharmaceutical statistics	<ul> <li>Pharmaceuticals use</li> <li>Pharmaceuticals per disease</li> <li>Use per product/substance (ATC code)</li> </ul>
OECD health statistics	<ul><li>Health status, medical service use, etc.</li><li>Seven areas of health care and 174 indicators</li></ul>
Statistics of public interest	<ul><li>Major health statistics</li><li>Health care statistics per disease/procedure, etc.</li></ul>
Health map	<ul><li>Disease analysis by region</li><li>Analysis of medically underserved areas by region</li></ul>
Early detection of unusual patterns for patient safety	• Detection of unusual phenomena related to patient safety, cause analysis, etc.
Information for supporting health care business administration	<ul> <li>Opening/closing of providers</li> <li>Medical demand</li> <li>Information on highly prevalent diseases by age</li> </ul>





As part of the Open Healthcare Big Data System, HIRA also offers a Health Map Service, which combines geographic information system data with health care data. Users can see visual representations of data such as the locations and current status of health care institutions, distribution of health resources, prevalence of diseases by region, and medically underserved areas. Figure 11 shows the process of creating health maps using HIRA data.

#### FIGURE 11 Creating Health Maps Using HIRA Data



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Figure 12 shows the geographic distribution of health care providers by facility level. The maps show that tertiary hospitals are concentrated in the Seoul metropolitan area but that the level of concentration differs by type of provider (e.g., long-term care hospitals vs. Korean medicine hospitals).





HIRA's Early Unusual Pattern Detection Service for Patient Safety monitors unusual data related to patient safety (such as the incidence of communicable diseases) at the national level. Using drug prescription information, claims data, and information on the distance between patients and their providers, the service generates predictive models on the incidence of certain communicable diseases. Information related to communicable diseases is sensitive, however, so access to this information is limited to the Ministry of Health and Welfare and the Infectious Disease Control Division of KCDC. Figure 13 shows the process from data collection to data-informed action. Figure 14 shows heatmaps of suspected incidence of infection.

### FIGURE 13 HIRA's Early Unusual Pattern Detection Service for Patient Safety



#### FIGURE 14 Suspected Incidence of Infection by Region and Patient Movement



HIRA's Medical Image Diagnosis Support Service for Cerebral Aneurysm Cases uses deep learning technology to help doctors make quick and accurate diagnoses. It builds a medical image database of cerebral aneurysm cases and the diagnoses made by specialists. HIRA plans to make the service available to external users once it finishes making improvements to further verify the diagnostic results. Figure 15 shows an example of medical image diagnosis using deep learning.

#### FIGURE 15 HIRA's Medical Image Diagnosis Support Service for Cerebral Aneurysm Cases



### Accomplishments and Challenges

HIRA's data system has evolved over a long period. When HIRA first started using its claims data, it put effort into improving the reliability and quality of the data. Then it gradually developed capabilities related to analyzing and using the data. The next step was establishing linkages with various external data sources. When the variety of data at its disposal increased dramatically, HIRA came to realize the need for systematic data governance over the entire life cycle of data. Figure 16 shows the relationship between the major challenges faced by HIRA and the key factors that enabled it to overcome those challenges. The challenges are grouped into three areas: data reliability, data usability, and the organization and culture related to handling data.



Key measures implemented by HIRA have included:

- DATA QUALITY MANAGEMENT SYSTEM. HIRA assigned certain IT personnel to data quality management and organized a quality management group. It also established a quality management process with designated roles and responsibilities. The Data Quality Management System uses standards such as critical-to-quality characteristics and data quality indicators, and it regularly measures the quality of data and corrects any errors. HIRA has its data quality management audited by two external organizations and has obtained a data quality certification (which measures the consistency of data values) and data security certification (related to encryption and access control) every year since 2011. Since 2017, HIRA has also had its information life cycle management activities evaluated by the Public Data Policy Division of the Ministry of the Interior and Safety.
- **PERSONAL INFORMATION PROTECTION.** HIRA has instituted procedures and measures to protect personal medical information. Since 2009, sensitive information such as patient names and unique ID numbers has been encrypted and access to certain tables has been strictly controlled. Staff members who are responsible for related tasks use individual access IDs and cannot tamper with their access history. When medical data are made available to external parties, such as through the Open Healthcare Big Data System, they are processed in advance so individual patients or hospitals are not identifiable in the data.
- DATA STANDARDIZATION SYSTEM. HIRA developed a data dictionary to ensure that all of its databases use consistent and standardized terminology and domains. Data architects must also use the standardized terms within the data modeling software. The Data Standardization System specifies use of metadata and entity relationship diagrams (blueprints for data) that can be easily viewed and used by anyone on the HIRA staff.

The system prevents inherent data errors and plays an important role in promoting a consistent understanding of data items.

 TRAINING. Since 2004, a year after it built its data warehouse and its data integration and analysis system, HIRA has offered in-house certification training for medical data analysts, producing around 700 analysts as of 2018. It also conducts two education sessions on health care data analysis each year for external users.

HIRA is looking to apply the newest artificial intelligence (AI) technologies to health care data, including for AI-based claims review and image diagnostics. Claims data will be a crucial part of training data for AI processes.

Data use in South Korea is still quite limited, however, considering the excellent conditions for data collection, including high-speed broadband, high penetration of smartphones, and strong public infrastructure (including the e-government system). Limitations on expanded data use include regulatory ambiguity regarding privacy and data security and public concerns about leakage of personal information. Issues such as whether HIRA's claims data should be provided to private insurance companies or overseas companies have been subjects of debate.

Another issue is whether HIRA's data can be considered health care data since claims data are prepared separately from medical charts and inconsistencies can arise between claims data and electronic medical records. HIRA is working to expand the data it collects for claims review and health care quality assessment, and it is considering ways to get electronic medical records data directly from health care institutions through real-time data linkages.

# **OTHER COUNTRY EXPERIENCES**

In addition to South Korea, many of the other countries in the collaborative have used claims data to improve their health system. This section provides examples from Ghana.

#### USING CLAIMS DATA IN GHANA

In 2006, Ghana implemented the National Health Insurance Scheme (NHIS) to replace the existing "cash-and-carry" health financing system. The objective of the NHIS is to achieve UHC and to increase access to health care services. The NHIS benefits package covers 95% of the disease conditions in the country. Clinical care services provided under the scheme are broadly categorized into outpatient services, inpatient services, oral health, eye care services, maternity care, and emergency care.

All participating health facilities under the NHIS must be accredited by the National Health Insurance Authority (NHIA). Those facilities submit claims either electronically (using the digital eClaims platform) or through a paper-based system. The processing and management of claims data and generation of analytics are the responsibility of the NHIA's Claims Processing Center.

The NHIS uses claims data to inform decision-making for both clinical and nonclinical operations. Clinical data provide insight into the quality of care administered by providers and the effectiveness of UHC interventions. Nonclinical data are useful for evaluating technology-related processes, infrastructure, and human resource management.

The data can provide insights in the following areas:

- Quality of care: Data include key indicators of the quality of care administered to patients, such as prescriptions, medical diagnostics, patient hospitalizations, and compliance with clinical protocols.
- **Disease prevalence:** Data provide details of disease prevalence with analytics on trends at primacy, secondary, and tertiary facilities.
- Health promotion: The NHIA can use data when working with major health care providers to devise strategies for preventive care and promoting healthy lifestyles.
- Software development: The NHIA uses data in its routine consultations with software developers on issues of data collection, data quality assurance, and system interoperability.
- Technology and connectivity: Trends analyses can reveal challenges with technology and connectivity. The NHIA can work with health facilities, software developers, and others to develop best practices and recommend IT systems to support claims data operations.
- **Capacity building:** Data can help identify training needs for providers in order to reduce rejected claims.
- **Data security:** Data can indicate how security measures are addressing issues of privacy, confidentiality, and integrity of patient data. Adherence to legal and regulatory frameworks (such as Data Protection Act 843, 2012) is critical at provider sites as well as at the NHIS.
- **Fraud detection:** Data can help detect health insurance fraud. The NHIA has a prosecutorial mandate to investigate and take action in cases of health insurance fraud.

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# CHALLENGES AND SOLUTIONS

Table 7 summarizes challenges and solutions related to using claims data that countries in the Data Foundations Collaborative shared with one another, organized by category.

#### TABLE 7 Using Claims Data: Challenges and Solutions

CATEGORY	Challenges 🔶 🔶	Solutions
Data Quality	<ul> <li>Data quality is poor-paper forms may not be validated, signed, or stamped, and data errors persist, especially in diagnostic coding.</li> <li>Capitation payment models may limit the amount of detailed claims data available.</li> </ul>	<ul> <li>Transition from paper to electronic claim submission. (Ghana, South Korea)</li> </ul>
Data Integration, Transferability, and Access	<ul> <li>Data are not integrated, and there is a lack of working linkages between public data systems.</li> <li>Data claims and hospital data are separate and not easily accessible to the MOH.</li> <li>There are few incentives for health workers to share data.</li> <li>Sometimes there are no deadlines to report data to the MOH.</li> <li>Challenges with data sharing and data harmonization between the national payer / NHIS and the ministry of health.</li> </ul>	<ul> <li>Most countries have or are working on a data reporting platform for claims data, generally with a goal of connecting these data with MOH and care delivery data at the national level.</li> <li>Countries without national insurance schemes (Malaysia) or that do not rely on claims data as the primary source of clinical data (Indonesia) use other data sources to provide insights into quality of care and services.</li> </ul>
Infrastructure	<ul> <li>Connectivity and hardware issues persist, and not all health facilities submit data electronically due to lack of infrastructure and human resource gaps.</li> <li>Data storage needs are not met.</li> </ul>	<ul> <li>Most countries are planning for, implementing, or improving insurance/payer systems and working to increase electronic claim submissions.</li> </ul>
Analytics and Visualization	<ul> <li>Review of data is duplicated by HIRA and NHI. Where data are entered manually, reporting time is slower.</li> <li>Multiple data collection processes used by health maintenance organizations and government agencies create confusion and additional challenges.</li> </ul>	<ul> <li>Plan for how clinical data in health records can be used for claims billing (i.e., to align clinical coding standards to support both clinical and billing needs). See the JLN e-book titled Connecting Health Information Systems for Better Health. (Multiple countries)</li> <li>Use claims data to improve operational efficiency, financial management and budgeting, and population health indicators. (Multiple countries)</li> </ul>

#### TOP 10 USES FOR CLAIMS DATA

The countries in the Data Foundations Collaborative identified the following valuable ways to use claims data.

- 1. To track disease demographics and disease patterns
- 2. To help assess facilities and improve the quality of care
- 3. To give providers feedback on their performance
- 4. To inform medicine purchasing, prescribing, and dispensing
- 5. To predict future expenditures, guide budgeting, and identify budget priorities
- 6. To assess health programs and guide program implementation, expansion, and modification
- 7. To help define benefits packages
- 8. To help detect fraud
- 9. To review insurance premium rates
- 10. To share with stakeholders for research purposes

# STAGES OF MATURITY

As the 10 countries in the Data Foundations Collaborative synthesized their experiences with using claims data, certain characteristics and patterns emerged. They grouped the characteristics into a simple maturity model with three stages—early, middle, and mature—to indicate a progression of priorities and activities. (See Table 8.) Countries can use this model to get a sense of their next steps and the associated challenges.

### TABLE 8 Stages of Maturity in Using Claims Data

EARLY STAGE	MIDDLE STAGE	MATURE STAGE
<ul> <li>Physical infrastructure is in place, but no collection of claims data (or no national insurance scheme).</li> <li>Moving from paper to electronic claim submissions.</li> <li>Programs and investments focus on increasing data quality and reliability.</li> </ul>	<ul> <li>Increase in electronic submissions.</li> <li>Data storage needs addressed.</li> <li>Harmonization of data from different sources (including care data and billing data).</li> <li>Data are shared between the MOH and NHIS.</li> <li>Capacity building and training of staff on claims data analytics and use.</li> <li>Initial connections between internal and external data sources to produce "big data."</li> </ul>	<ul> <li>Private-sector data integrated into the system.</li> <li>Data warehouse and reporting platforms for claims data are in place.</li> <li>Claims data are used as a proxy for population health data or supplement data from clinical care.</li> <li>Analytics capacity and tools are in place to use claims data for more than operations.</li> <li>Governance structures for the entire data lifecycle are in place and reinforced throughout the health system.</li> </ul>

### **KEY RECOMMENDATIONS FROM JLN COUNTRIES**



- » Reduce the number of different processes used by agencies or insurance schemes to collect and process data.
- » Transition claims data collection from manual to electronic systems.
- » Broaden the uses of claims data. For example, use clinical data to improve billing and explore how claims data might be used to inform research and development.
- » Improve data standardization and sharing among tertiary facilities, payers, and the MOH.

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# NEXT STEPS: GLOBAL LESSONS AND RECOMMENDATIONS

The three case studies in this document illustrate that countries share a number of challenges and opportunities related to using health data for chronic disease management and financial management and using claims data to improve their overall health system. In particular, many countries must first address complicated, foundational challenges with their data systems. These challenges require transformative thinking and solutions that address the fragmentation of health information.

Here are some recommendations for successfully using data for health system strengthening, organized by category:

### GENERAL

- » Invest in systems, processes, and policies to connect health system players that want to use data, including national payers, ministries of health, claims processors, and health care providers.
- » Standardize data languages and coding systems—and the applications that use them.
- » Provide incentives for health workers to engage in the data use system at all levels, by providing an information feedback loop that provides evidence of the benefits of data use.
- » Before scaling up health data systems nationally, develop strong data use policies and a data governance framework that includes the entire health system.
- » Implement data privacy, security, and access approaches that allow individuals to own and control their data and meet the requirements of health programs to use data to improve health outcomes.
- » Adopt new technologies that use machine learning, digital diagnostics, and other advanced features.

### **GOVERNANCE AND POLICY**



- » Implement data privacy, security, and access approaches that allow individuals to own and control their data and meet the requirements of health programs to use data to improve health outcomes.
- » Implement clear guidance and policies on data sharing between government bodies and with private-sector health providers.
- » Implement clear guidance and policies on data privacy and ownership.

- » Conduct strategic planning and budgeting for large technology upgrades to data systems.
- » Before scaling up health data systems nationally, develop strong data use policies and a data governance framework that includes the entire health system.
- » Use data systems that are designed for interoperability.
- » Create data dashboards to support decisionmaking.

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### SYSTEMS AND TOOLS

- » Invest in systems, processes, and policies to connect health system players that want to use data, including national payers, ministries of health, claims processors, and health care providers.
- » Implement fully digitized data collection that is integrated into care delivery, reduces redundant data collection systems, removes potential sources of errors, and supports realtime reporting.
- » Create data warehouses or centralized data storage.
- » Adopt new technologies that use machine learning, digital diagnostics, and other advanced features.
- » Address infrastructure problems and use tools (such as mobile phones or tablets) to allow for electronic data entry at the point of service when possible.

### **STANDARDIZATION**

- » Standardize data languages and coding systems—and the applications that use them.
- » Create and enforce data standards across the health system.
- HEALTH WORKFORCE
- » Provide incentives for health workers to engage in the data use system at all levels, by providing an information feedback loop that provides evidence of the benefits of data use.
- » Create an incentive structure to promote high-quality data collection and promote training for the health workforce on data collection and analysis.

» Integrate data from all levels of the health system, and integrate data from public and private-sector providers.

- » Train staff in data collection, analysis, and visualization tools and techniques.
- » Ensure that health system data are shared with frontline health workers to support the improvement of services.





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# **ADDITIONAL JLN RESOURCES**

PROVIDER PAYMENT REFORM AND INFORMATION TECHNOLOGY SYSTEMS



This paper addresses key implementation questions raised by countries on the journey toward UHC and provides concrete data to help policymakers and IT professionals understand how the provider payment methods used affect the IT systems underpinning them.

 $www.jointlearningnetwork.org/uploads/files/resources/IT-PPM\_FINALlores\_online.pdf$ 

CONNECTING HEALTH INFORMATION SYSTEMS FOR BETTER HEALTH

HEALTH INSURANCE TERMS

GLOSSARY



This e-book is a reference guide for countries that want to link their UHC and eHealth information systems using a standards-based approach. It provides a set of steps to take and links to resources for developing a national eHealth standards framework. Real-world perspectives are provided by eHealth experts based on their countries' eHealth and UHC experience.

www.jointlearningnetwork.org/uploads/files/resources/Connecting-Health-Information-Systems-for-Better-Health-FINAL-20141024.pdf



This glossary on the JLN website includes commonly used terms in health insurance.

www.jointlearningnetwork.org/technical-initiatives/information-technology/glossary

REQUIREMENTS FOR NATIONAL HEALTH INSURANCE INFORMATION SYSTEMS



This document includes draft functional-level requirements for determining eligibility, enrollment, preauthorization, claims processing, and payment collection in insurance systems. These requirements can be adapted and customized for any context.

www.jointlearningnetwork.org/uploads/files/resources/ NHIIS\_Draft\_Requirements\_PhaseII\_final\_7.31.2012.pdf Determining Common Requirements for National Health Insurance Information Systems



This report provides practical information, tools, and resources that country decision-makers can use as they plan for national-level health insurance information systems.

www.jointlearningnetwork.org/uploads/files/resources/NHIIS\_Phase\_1\_Public\_Report\_ JLN\_IT\_Workshop\_FINAL\_Jan182012\_A4\_0.pdf

PROMOTING INTEROPERABILITY OF HEALTH INSURANCE INFORMATION SYSTEMS THROUGH A HEALTH DATA DICTIONARY



This paper provides an overview of health data dictionaries, the role they play in UHC schemes, and how they can promote interoperability.

www.jointlearningnetwork.org/uploads/files/resources/ HealthDataDictionarySeries\_8.5x11.pdf

JOINT LEARNING NETWORK Survey: Information System Support Needs for National Health Insurance Schemes



This presentation summarizes the results of an online survey and follow-up interviews with country representatives on IT topic areas where JLN members would like additional support.

www.jointlearningnetwork.org/uploads/files/resources/ Joint\_Learning\_Network\_Survey\_Results\_Final.pdf



