Electronic Health Records in Colima, Mexico

CASE STUDY ON DESIGN AND IMPLEMENTATION

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COLIMA

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Executive Summary

This document is the result of the joint efforts of bi-national institutions of the United States and Mexico. The U.S. Agency for International Development (USAID) provided funding for the project through the MEASURE Evaluation project. Tulane University (United States) and the National Public Health Institute (INSP, in Mexico) developed the design and analysis. The document contains information on the main findings of the project, *Electronic Health Records Management System in Colima: Case Study on Implementation*. The main objective was to provide information related to the design and implementation of the Management of the Electronic Health Record in Colima (SAECCOL, in Spanish). The results are intended to serve as a guide for other states in Mexico, and other countries in Latin America and the Caribbean, to develop and strengthen their Electronic Health Records (EHR). The study was conducted between August and November 2011.

The methodology used was both quantitative and qualitative in nature. The quantitative aspect was used to define the state's socio-economic and epidemiological profile. To learn about stakeholders' perceptions of implementation and benefits, qualitative analysis was conducted, using in-depth interviews and focus groups of SAECCOL's managers, technicians, operators and users, at a local and federal level.

The SAECCOL is a system agreed upon among various state actors (doctors, information technology experts, managers and consultants of the state's health department, and other area professionals), adjusted to the needs of the state through national and international guidelines. The EHR is currently being updated and expanded according to the *State Development Plan 2009–2015*, which guarantees the budget and the continuity of the project. The use of the tool has fluctuated since it was implemented but it was expected that 99% coverage would be reached by the end of 2011.

One of the greatest benefits of the EHR is that it is a "homemade" tool molded to the requirements and demands of users. Project participants felt that were are still many challenges to address including a need to: adapt the system to current regulations, achieve interoperability among health units at different levels of care, ensure proper availability of infrastructure and support to improve data quality, to standardize processes, ensure the quality and efficiency of health services in general, and promote the use of information for the benefit of all users.

Acronyms

CAUSES	Universal Catalogue of Health Services
CENIDSP	Information Center for Decisions in Public Health
ICD-10	International Classification of Diseases, version 10
CNPSS	National Commission on the Protection of the Health Systems
CONAPO	National Population Council
DGIS	Directorate General of Health Information
EHR	Electronic Health Records
FGD	Focus group discussions
HIS	Health Information System
IMSS	Mexican Institute of Social Security
INEGI	Instituto Nacional de Estadística y Geografía
INSP	National Institute of Public Health
ISSSTE	Instituto del Seguro Social en Salud para los Trabajadores del Estado. The State´s Employees Social Security and Social Services Institute
NOM	Norma Oficial Mexicana (The Official Mexican Standard)
PEMEX	Petróleos Mexicanos
PO	Programa Oportunidades
SAECCOL	Sistema Administrativo del Expediente Clinico de Colima (Management of the Electronic Health Record in Colima)
SEDENA	National Defense Secretariat or Mexican Army and Air Force
SEDESOL	Secretaria de Desarrollo Social, (Social Development Secretariat)
SINOS	Sistema Nominal en Salud
SP	Seguro Popular (The Social Health Protection System or Popular Insurance Scheme)
SS	Secretaría de Salud de Colima (Secretariat of Health of Colima [SHC])
USAID	The United States Agency for International Development

Section 1   Introduction

The Electronic Health Record (EHR) is a tool for improving the quality, safety, and efficiency of health services. It also provides data, among other things, for assessing the health status of the user population and the performance of the health system (1). Mexico is in the process of implementing and expanding EHRs in order to provide standardized health information on patients that is available, accessible, safe, and effective (1).

Mexico has begun to introduce and use the EHR as part of the national strategy for monitoring and improving the quality of its health services. The Official Mexican Standard NOM-024-SSA3-2010 established functional objectives and functions that the EHR system software must observe to ensure interoperability, processing, interpretation, confidentiality, security, use of standards and information catalogs (2). One of the strategies in the medium term is for all states to implement EHR systems that can communicate with each other. It is believed that the use of standards for the EHR will improve database administration, transfer of data, and security of health information.

The country has made progress in the implementation of EHRs, even prior to the issuance of the NOM 024, but with different degrees of implementation across the country (2). Colima is one of the states that have implemented an EHR in Mexico; in 2005, Colima commissioned the design and implementation of its own EHRs, the Colima Health Record Management System or SAECCOL, based on the needs and expectations of the health system's workers and users. This case study of the use of the EHR in Colima was conducted in order to provide information regarding the design, implementation, and benefits of this system.

The SAECCOL operates in some public health centers and hospitals that offer health care to mostly beneficiaries of the *Seguro Popular* (SP) and *Programa Oportunidades* (PO).[1] The SAECCOL was developed by the state's Secretariat of Health (SS, in Spanish) to satisfy the demand for information regarding the costs of health interventions, medication supply, and other SP indicators. In addition, states such as Coahuila, Aguascalientes, Hidalgo, Mexico, Yucatan and Oaxaca have expressed interest in adopting the SAECCOL to suit their individual needs.

This report is the result of the joint efforts of bi-national institutions of the United States and Mexico. The U.S. Agency for International Development (USAID)

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[1] The *Seguro Popular* (SP) is part of the *Sistema de Protección Social en Salud* (or the national system of social security in health), which aims to provide health service coverage through a public and voluntary insurance program for low-income people who are unemployed or self-employed and who are not beneficiaries of any other social security program. *Programa Oportunidades* (PO) is a comprehensive program for people living in extreme poverty, suffering the highest rates of malnutrition, highest rates of common curable diseases, and with the highest school dropout rates. The program aims to combat poverty by improving the skills of its members and expanding their options to achieve higher levels of welfare by improving education, health, and nutrition. It also links with new services and programs designed to improve their socioeconomic status and quality of life. The PO consists of three components: health, nutrition, and education.

provided funding for the project through the MEASURE Evaluation. Tulane University (United States) and the National Public Health Institute (INSP, in Mexico) developed the design and analysis. The objective of this study is to document and analyze, using the case study technique, the process of designing and implementing SAECCOL in health services in the state of Colima. The study's results are intended to:

» assess the benefits and limitations of SAECCOL;
» make recommendations to improve the system; and
» suggest the adaptation and implementation of EHRs in other states of Mexico and in countries of Latin America and the Caribbean.

The quantitative aspect was used to define the state's socio-economic and epidemiological profile. To learn about stakeholders' perceptions of implementation and benefits, qualitative analysis was conducted, using in-depth interviews and focus groups of SAECCOL's managers, technicians, operators and users, at a local and federal level. The Institutional Review Boards of both the INSP and Tulane University approved the study protocol.

The information obtained provided insight to the social, economic, historical and institutional context in Colima, as well as to the technical and organizational factors that have influenced the design, implementation and use of the EHR.

The questions that guided this case study are:

» Why was an EHR designed and implemented in Colima? Who are the potential users of information? Did potential users participate in the EHR design and implementation? If so, how?
» What is the current status of implementation in SAECCOL health centers and hospitals?
» What are the SAECCOL benefits and limitations?
» What lessons have been learned since implementing SAECCOL that can be used in other states in Mexico and in other countries in Latin America and the Caribbean?

The report is structured as follows: first, a profile of Colima is presented focusing on the social, demographic, and health characteristics of the state. This is followed by background information about EHRs in Mexico (regulatory and functional guidelines). The next section discusses the methodological approach of the study (data sources, data processing, type of analysis, study limitations, etc.). This is followed by presentation of the key findings and a discussion section. The report continues with recommendations for improving the EHR and lessons learned that can be shared with other states and countries.

Section 2   Background

2.1   CHARACTERISTICS OF THE STATE OF COLIMA

2.1.1   General Overview

Colima is one of Mexico's 32 states and is located along the western coast of the country. It is bordered to the North by the state of Jalisco, to the South by Michoacán and to the West by the Pacific Ocean. It is divided into 10 municipalities: Colima (capital), Armería, Comala, Coquimatlán, Cuauhtémoc, Ixtlahuacán, Manzanillo, Minatitlán, Tecomán y Villa de Álvarez (Figure 1). Colima is a small state with an area of 5,627 km2 representing 0.3% of the land surface of Mexico and ranks 28th nationally in terms of size.

Figure 1   The State of Colima
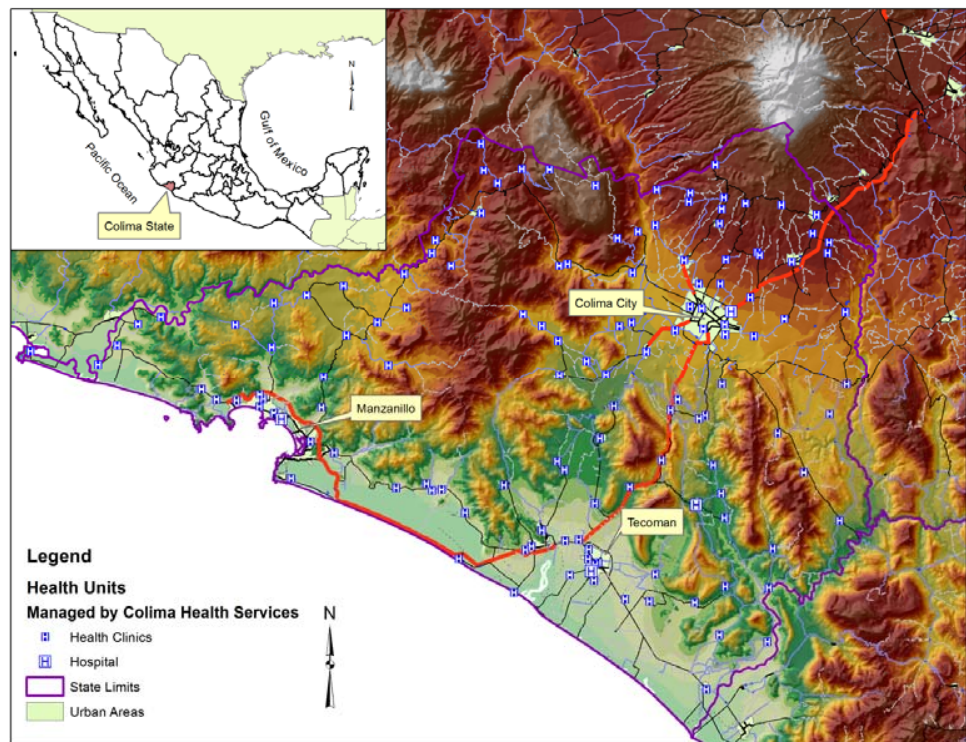
Source: Prepared by CENIDSP with data from the National Health Information System, the Corps of Engineers and cartographers of the National Defense Secretariat and the INEGI, 2011 (9).

2.1.2   Sociodemographic Profile

According to INEGI, Colima had a total population of 650,555 (0.6% of the country) making it 31st in population ranking among the 32 states in 2010 (9). Forty-eight percent of the population is male (322,790) and 89% of the population resides in urban areas. The growth rate for 2005–2010 was 2.8%. Life expectancy is 73.2 (73.1 for men and 73.2 for women), five years less than the national average.

As indicated in Figure 2, Colima has a young age structure, with a broad base, 35.1% of the population 20 years of age and younger. The age group with the largest number of people is 10-14 years (9.3%). About six percent of the population is over 65 years of age. The total fertility rate is 1.9 children per woman, which is relatively low. In terms of mortality, it has a crude death rate of 5.7 deaths per thousand inhabitants, similar to the national average and an infant mortality rate of 11.3 deaths per thousand births. The annual growth rate is 1.2 per hundred thousand inhabitants. Seven out of every 1,000 Colima-natives speak an indigenous language; the average schooling is 8.9 years of education (equivalent to third junior year), placing it above the national value (8.6). The state contributes 0.5% of the total GDP of Mexico, with the trade sector contributing the most to the state GDP. The state of Colima has a relatively high Human Development Index, ranking 11th out of 32 states in Mexico.

Figure 2   **Age Distribution of Colima's Population, 2010**
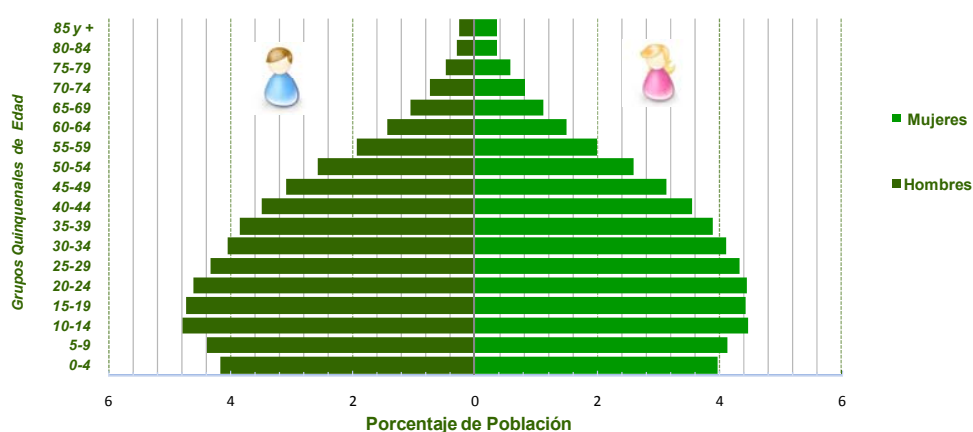
Source: Prepared by CENIDSP/INSP from population projections from 1990 to 2012 CONAPO / SS(2). Available at the Directorate General of Health Information, 2011.

2.2   HEALTH SYSTEM OF COLIMA

2.2.1   Populations Who Are Not Beneficiaries of the Social Security Institutions

In 2011, 44.0%, or 270,737 residents, of Colima had no access to Social Security.[2] The population without Social Security (people and their families who have no formal employment) increased 4.8% between 2005 and 2010 (Figure 3). In recent years, the population served by SP has increased substantially (Figure 3). The total number of families benefiting from SP increased to 231,301 in 2010, representing 80% of the population served by the SS and 32.8% of the state's population.

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[2] Social Security depends on the status of the worker and has health schemes for workers and their families. The population without Social Security includes people and their families who have no formal employment.

Figure 3   Health Services Beneficiaries, Colima 2005–2011
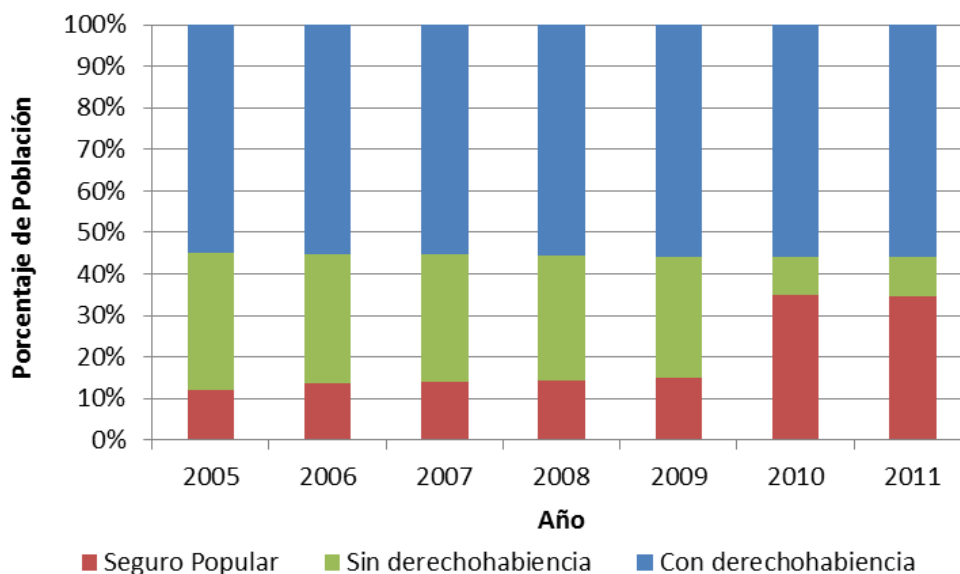
Source: Compiled from the Municipal-SIMBAD Database. INEGI, 2011. Projections of Population 1990 to 2012. CONAPO/ SS(2;9).

The population without Social Security, served by the SS in Colima, has a similar profile to the rest of the population in the state, albeit with some variations. In this case, the population is younger, with 37.9% of the population 20 years of age or younger, while those aged 65 years or older was only 5.2%. While 15% of the population of Colima is less than ten years of age; 18.3% of the population without Social Security is less than ten years of age (Figure 4).

Figure 4   Age Distribution of the Uninsured Population in Colima in 2010
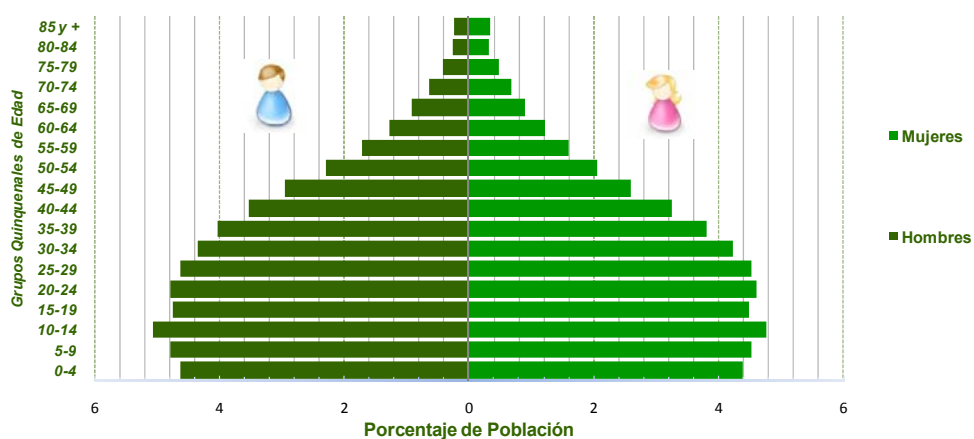
Source: Prepared by CENIDSP / INSP from population projections from 1990 to 2012 CONAPO/SS (2).

2.2.2   Health Services Description

The SS of Colima is organized into state offices and is geographically divided into three health jurisdictions for the provision of health services.[3] It is composed of 119 health clinics (primary level care; 21 urban and 98 rural), four hospitals, and several specialized health outpatient clinics (secondary level care) that are not jurisdiction specific. Colima has one tertiary level care facility, an oncology center, but this is not currently using SAECCOL.

The SS health units serve 44% of the population that has no access to Social Security. The rest of the population is served through the Social Security Institute for State Workers Health (IMSS), ISSSTE, *Petróleos Mexicanos* (PEMEX), and the Ministry of National Defense (SEDENA), either as direct or third-party beneficiaries. Most of the populations served by the SS are SP and OP beneficiaries.

Doctors, nurses, and dentists staff the health units depending on the size of the population. Most of the units are in rural locations. Each health unit is responsible for one or more communities. They provide preventive care and promote public health priority programs including reproductive health, childhood health, chronic degenerative diseases, infectious diseases, vector-borne diseases, and others. They also engage in providing mobile health services. For continuity of care of complex conditions, patients are sent to one of the state hospitals. Each health unit is assigned to a hospital for health referrals in each of the health jurisdictions.

The patient care flow begins with a service request at the reception desk or *archivo*[4] of the health unit, where the patient's socio-demographic data, including SP membership ID is recorded. Then, a health appointment is made. Vital records registration is conducted and some preventive care given at the nurse's station prior to the consultation with the physician. During the health examination, a health record or a clinical note is registered, and preventive care is given based on the parameters established by the *Línea de Vida (Life Line)* according to patient age and sex and regardless of the cause of consultation. *Línea de Vida* is a group of basic actions to prevent disease and promote health self-care. When necessary, patient treatment and monitoring is offered, as well as laboratory tests and X-rays upon request and prescriptions or referrals as needed.

Health jurisdictions manage the personal health services that are carried out in the health units as well as public health activities, such as vector-transmitted disease control and epidemiological surveillance. In addition, they carry out monitoring of prevention programs, including data collection needed to manage health programs.

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[3] The creation of a Health Jurisdiction is determined by regions, i.e. the formation of geo-demographic areas delimited by ethnic, cultural, economic, political, social, environmental and common development characteristics, created in order to plan for the provision of services, optimize the use of resources, and meet the particular needs of the health regions.

[4] Some health units don't have formal reception areas and the request for medical services is done in the office that stores the medical records for the health unit. In Spanish, this office is called *archivo*.

The SS manages and monitors health programs carried out in health units and hospitals. The state plans and monitors public health activities and maintains a communication channel with health jurisdictions, other health institutions, and with different federal agencies of the Ministry of Health.

2.2.3   Health Problems in Colima

In 2010, there were 12,992 hospital discharges in SS hospitals and medical centers, of which over 50% corresponded to five causes (Table 1):
1. single spontaneous delivery,
2. abortion,
3. cholelithiasis and cholecystitis,
4. appendicitis,
5. nephritis and nephrosis.

Table 1   Leading Causes of Hospitalization in the Colima, Secretary of Health, 2010

No.	Cause	Discharges	Percent
1	Single spontaneous delivery	4,006	17.9
2	Abortion	1,023	4.6
3	Cholelithiasis and cholecystitis	538	2.4
4	Appendicitis	527	2.4
5	Nephritis and nephrosis	488	2.2
6	Diabetes mellitus	458	2.1
7	Leukemia	445	2.0
8	Fractures of the shoulder, arm, and forearm	289	1.3
9	Asphyxia and birth trauma	279	1.2
10	Pneumonia and influenza	277	1.2
11	Others	14,007	62.4
Total		*22,337*	*100*

Source: Directorate General for Health Information (DGIS)20. Base Hospital Discharge Data for morbidity in Public Institutions, 2010.

These hospital discharges occurred in health units of the SS, where 81.9% were beneficiaries of the SP and 17.3% had no form of health insurance.

The state of Colima registered 3,107 deaths in 2009, with a higher incidence in people 85 years or more. The main cause of mortality in 2009 was diabetes mellitus and other chronic degenerative diseases. Other causes of death include cirrhosis, motor vehicle accidents, and malnutrition. Mortality rates are higher for several conditions, than the rates recorded nationally (Table 2).

Table 2   **Leading Causes of Death, Colima, 2009**

No.	Cause	Standardized rates * (per hundred thousand)	
		Colima	National
1	Diabetes mellitus	81.5	69.0
2	Ischemic heart disease	63.4	56.1
3	Cirrhosis and chronic liver diseases	30.0	25.0
4	Cerebrovascular disease	24.9	27.5
5	Chronic obstructive pulmonary disease	21.4	19.3
6	Motor vehicle accidents (traffic)	19.2	11.2
7	Hypertensive diseases	19.2	16.1
8	Acute lower respiratory infections	18.3	16.5
9	Assault (homicide)	11.7	17.1
10	Protein energy malnutrition	11.4	7.4

* Standardized rates based on the Mexican population, 2009.

Source: Compiled from Department of Health Information (DGIS). Deaths Database 1979-2009.

The main increase in mortality rates between 1980 and 2009 was due to diabetes mellitus (259.3%) and ischemic heart disease (197.9%). Meanwhile, acute lower respiratory infections, motor vehicle accidents, and assaults showed the largest declines during the same period, with 97.2%, 40.3%, and 38.1%, respectively (Figure 5).

Figure 5   **Principal Causes of Mortality, Colima, 1980–2009**
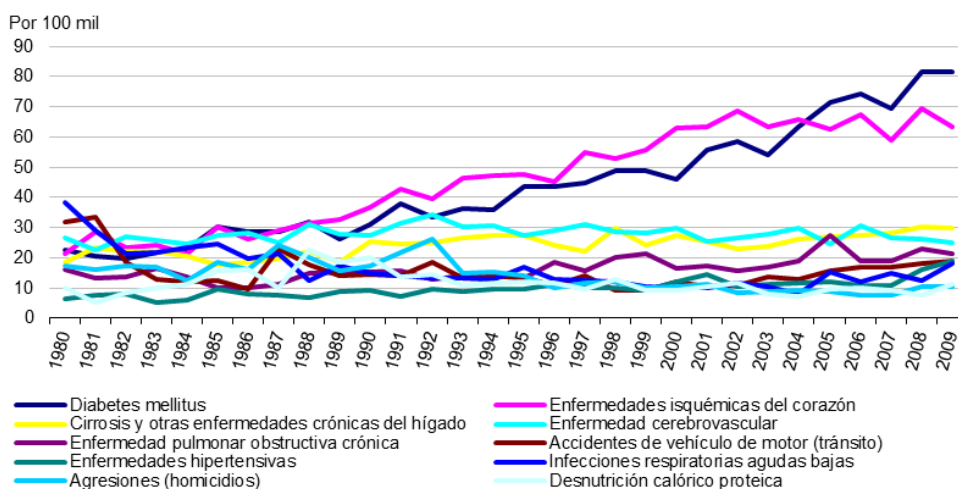
Source: Compiled from Department of Health Information (DGIS). Deaths Database 1979-2009. (22)

2.3   NATIONAL GUIDELINES ON ELECTRONIC HEALTH RECORDS

The EHR in Mexico is intended to systematize, standardize, and update health records related to preventive, curative and rehabilitation services carried out by public, private, and social health care service providers of the National Health

System. It aims to ensure the use of national standards for the collection of patient data and their use, confidentiality, and authorized access. In addition, the EHR provides support to standardize processes such as: person-to-person information exchange, functional interoperability (terminal-to-terminal, PC-to-PC, server-to-server, institution-to-institution information exchange), terminology, security, messaging, and structure of records (19).

The EHR arose from the need to increase efficiency and improve the quality of health services provision. Various national standards issued in recent years have supported EHR development and functioning, including:

» NOM-168-SSA1-1998. Medical Records. September 1999. It sets the scientific, technological and managerial criteria required in the design, integration, use and archiving of paper based health records (17).

» Resolution amending NOM-168-SSA1-1998. Medical Records. July 2003. It amends paragraphs 5.6 and 5.11 and establishes that: 1) the information contained in the health record shall be handled with discretion and confidentiality, serving the scientific and ethical principles that guide health practice; 2) the use of electronic, digital, electromagnetic, optical, magneto-optical media or any other technologies was allowed as part of a health record (18).

» NOM-024-SSA3-2010. August 2010. Establishes functional goals that electronic health record systems products should observe in order to ensure interoperability, processing, interpretation, confidentiality, security and use of standards and information catalogs.

Additionally, the National Health Program 2007–2012 had as an objective to establish the infrastructure base for the adoption of the EHR and the management of health medical services. In 2003, the National Health Council appointed the Directorate General of Health Information (DGIS) to develop the EHR in the country (19) while the Specific Action Plan 2007–2012 of the National Health Information System, included elements to enable the portability of information contained in EHRs, ensuring the patient that a treating physician could access their health information, and giving the patient's clinical, laboratory and administrative history when needed, even if the patient is away from their primary residence.

2.3.1 Electronic Health Records in Colima

Colima designed and developed its own EHRs, SAECCOL, for the purpose of automated tracking and digital recording of the health history of the population affiliated with the *Seguro Popular* (SP) and of the general population at large. This project is part of the *Seguro Popular* (SP) Integrated Management System, which includes the automation of extensive areas of coverage. In 2005, the Ministry of Health of the State of Colima took over the development of the *Seguro Popular's* EHR and implemented it in the health units where IMSS-*Programa Oportunidades* affiliated patients are treated (3). The main objective is to satisfy information needs for the SP program, including information on health intervention costs, medication

supplies, and other indicators. The SAECCOL was developed at a time when there were no specific country guidelines for EHR development and implementation; therefore, it was tailored to the state's specific needs but following general international guidelines.

In the initial development phase, the Ministry of Health benefited from the support and advice of a group of doctors, developers and other professionals from diverse backgrounds who contributed ideas from their perspectives for this project. In November 2005, SAECCOL was piloted in two primary health care units to assess its performance. Subsequently, it was progressively extended to other health units and hospitals. In September 2011, when the study was carried out, the EHR was being used in 50% of health centers and three hospitals (75%); by the end of 2011 coverage was expected to reach 99%.

The implementation and training on how to use SAECCOL has been carried out by the SS's information technology specialists with the support of local universities, where doctors in training are instructed on its use. SAECCOL's implementation, operation, and development is headed by the SS's Communications and Information Technology Department, which consists of four support sub-areas: systems, information technology, branding, and government liaison.

SAECCOL was developed taking into account the existing regulations, and has been further adapted according to new regulations such as: NOM 168, NOM 024, international catalogs (ICD-10), national catalogs (Universal Catalogue of Health Services-CAUSES), Health facility unique ID catalogue (CLUES), and basic medication tables among others. It uses an interconnected model that allows it to work locally and be updated on a scheduled basis via the state network. It has:
» desktop and web development,
» real-time monitoring, and
» Interface Cobas 111.

Within SAECCOL, there are modules already installed and operating in both health centers (primary level care) and hospitals (secondary level care). The primary level of care is provided with modules for: scheduling, insurance information, vital records, health history, health promotion, laboratory, referral and counter-referral, issuing prescriptions, pharmacy, and management. The management module is only available to the directors of healthcare centers and hospitals; the other modules are available to physicians at the point of care. In addition to those components already described, the secondary level of care (hospital services) has admissions and emergency modules. Social work modules, laboratory, X-rays and hospital checkout modules are being implemented. Additional hospital modules beyond admissions and emergency modules as well as nursing modules are under development.

The method used to save information collected through the EHR in each health center and hospital varies depending on the technological capacity of each institution. In general, the data from each computer that operates the EHR is backed-up to hard disks or to a server at the health unit. At the time of the case study, the SS of Colima was in the process of copying all of the EHRs data produced

throughout the state from USBs or CDs to a central server. This server is not connected to all of the health units that operate the EHR.

In the near future, it is expected that SAECCOL will achieve 100% coverage of health units in the state of Colima. There are provisions to develop and implement new SAECCOL modules to cover all hospital activities, and to develop a statewide communication network to synchronize EHRs data and to implement telemedicine modules where appropriate. Efforts to modify SAECCOL to comply with the newly released official norm NOM-024 and to achieve interoperability with the patient based information system used for the beneficiaries of Programa Oportunidades SINOS4 (Sistema Nominal en Salud SINOS) are a priority.

It should be noted that the health chapter of Colima's 2009–2015 State Development Plan (4) aims to install and operate the SAECCOL in all health services units; this marks an unprecedented milestone as it assures short- and medium-term budget appropriation and thus project sustainability.

A recent INSP study on EHRs in Mexico found that SAECCOL's advances are considered to be intermediary at a federal level, complying with about half of the NOM-024 guidelines. The state perceives this advance to be much greater (12).

Section 3   Methodology

3.1   INTERAGENCY SUPPORT

Agencies in both the U.S. and Mexico supported this project. The U.S. Agency for International Development through the MEASURE Evaluation project, (Cooperative Agreement GHA-A-00-08-00003-00), funded the project. The INSP was responsible for data collection and data processing. Data analysis was conducted by Tulane University (United States) and INSP (Mexico).

3.2   MIXED ANALYSIS

The analysis used quantitative and qualitative techniques. The quantitative technique was used to contextualize the demographic and epidemiological characteristics of Colima, while the qualitative component was used to explore the perspective of the actors in SAECCOL with respect to its design and implementation.

3.2.1   Quantitative Analysis

Secondary Information Sources: The demographic and epidemiological profile of Colima was built using secondary information about the population, its health status (hospital discharge and mortality), and the structure and functioning of the health system, among other topics. The data sources used were:
» Population and Household Census 2010—National Institute of Geography and Statistics (INEGI in Spanish) (9)
» Population Projections, National Population Council (CONAPO, in Spanish) (2)
» Vital Statistics Mortality Data-INEGI/SS
» Hospital discharges—Health System

The data were processed using the Statistical Package for Social Sciences (SPSS) version 19. Tables and graphs were generated using Microsoft Excel 2010.

3.2.2   Qualitative Analysis

The qualitative component of the study was designed to include in-depth interviews with key informants thought to be critical in the design, implementation, and use of the SAECCOL, and Focus Group Discussions (FGD) with physicians who use SAECCOL in hospitals and health clinics.

Interviews and focus groups
In-depth interviews and FGD were conducted using semi-structured guides designed to extract information about the issues previously identified. The guidelines used provided interviewers with a series of standard questions; the guides were flexible enough to delve into specific issues when necessary (Annex 1). Both tools encompassed the following topics:
» Profile of the person interviewed (job title, work experience, EHR experience, etc.)

- » EHRs design and implementation
- » Potential information users
- » Current status of implementation
- » Benefits and limitations
- » Lessons learned and experiences to share
- » Recommendations and concluding remarks

Each participant was asked to give her or his informed consent (orally) in order to conduct the interview. In addition, an information card was handed out which contained details such as name, phone, and e-mail of the researchers responsible for the project in the INSP and of the ethics committee of the institution. The research protocol, which included the interview and focus group guides and the description of the informed consent procedures, were approved by the ethics and bio-safety research committees of INSP and Tulane University. The standardized interview guides were designed and tested with volunteer physicians in Mexico City. Interviewers were trained to adhere to the interview protocol in order to minimize interviewer bias.

Sample Selection: Purposive sampling was used to select informants. In this method, participants are chosen strategically because they know well the issues to be addressed; in this case, the respondents worked with SAECCOL at all different levels (federal, state, health unit). A list of 60 potential informants was created by study researchers based on discussions about the types of informants that should be included in the interviews. Twenty-six in-depth interviews were conducted. Interviews in Colima were usually scheduled within two days of requesting an interview. In the Distrito Federal (Federal District of Mexico, location of the federal government), it took up to two weeks to schedule the appointments. Interviews took place at the informant's place of work, either at health clinics, hospitals, or state or federal offices.

The initial contact with possible informants in Colima was made through the Colima state SAECCOL IT professionals who were able to identify key individuals and health units. The experience of the health personnel in the use of SAECCOL and their availability were also taken into account.

The categories of key informants selected are:
- » Colima state health depa rtment directors
- » Directors of the SP and *Oportunidades*
- » Information technology specialists
- » Directors of health clinics and hospitals

Directors or sub-directors of the four hospitals in Colima were included in the in-depth interviews; directors of four of the 119 health clinics were selected. The hospitals and clinics were categorized as either pioneer (have been using SAECCOL since the beginning of implementation) or recent adopters (started using SAECCOL between January and April of 2011) facilities. The two pioneer health centers were also used to pilot SAECCOL. The two recent adopter facilities were selected because they were the most recent facilities that implemented SAECCOL.

Four FGD were conducted with physicians including physicians in a pioneer (early adopting) hospital, physicians in a recent adopting hospital, physicians in a pioneer health clinic, and physicians in a recent adopting health clinic. Permission from the managers and directors was obtained at each center or hospital to minimize disruption of health services provision. Finally, managers gave physicians information on the date, time, and place where activities would take place so that they could join an FGD. Although the managers did not stress that participation was voluntary, the researchers clearly expressed the voluntary nature of the FGD and informed participants that they were free to participate and could leave at any time. The directors of the selected facilities for the FGD were also included for in-depth interviews. The project was well received by the participants in Colima and everyone invited participated in the interviews and FGD.

An Internet search was carried out to identify individuals, who fit the required profile at the federal level, i.e., they had EHR-related tasks, at the Ministry of Health, SP, or *Oportunidades* Program at the federal level. After identifying the potential interviewees, appointments were requested by email and on some occasions, some of the potential interviewees recommended other potential interviewees. In this case, a visit to the office of the potential interviewee was made; in all cases it was possible to interview them at the time of the visit. These interviews were conducted in the Distrito Federal.

Data Collection and Management: The interviews in Colima were conducted August 3–19, 2011, and the interviews in the Distrito Federal were conducted September 1–19, 2011.

The interviews were conducted in Spanish by two INSP researchers. In most cases the interviewers went together to appointments. On such days, one would ask the questions and the other would take notes of the relevant information that arose during the interview. In the FGD, one of the researchers served as the main interviewer, while the other one served as logistics support and reinforced questions that required further elaboration. In total 27 interviews were conducted (21 in Colima and six at the federal level) and four focus groups were carried out with the following composition:
» Focus group 1 (Health Center, recent implementation) = 10 participants
» Focus group 2 (Hospital, recent implementation) = 8 participants
» Focus group 3 (Pioneer hospital) = 9 participants
» Focus group 4 (Pioneer health clinic) = 8 participants

The qualitative data collection was complemented with field notes and photographic records. The interviews were audio-recorded. Focus groups were audio- and videotaped simultaneously. The quality of some recordings was poor due to external noises that did not allow the voices to be heard clearly, or due to failure of the recording instruments; however, all interviews and information were recovered using field notes.

The audio files were transcribed into Microsoft Word documents and reviewed by the interviewers prior to analysis. The audio files were stored digitally and copies of

the transcripts were kept. Each interview subject was assigned a unique identification code consisting of letters and numbers so as not to reveal the real identity of the participant. The codes were assigned as follows:

For interviews:
» EHR: Electronic Health Record
» Consecutive number
» T (technical) or D (manager)

For the focus groups
» EHR: Electronic Health Record
» Consecutive number
» GFC: Grupo focal en Colima (Colima focus group)
» Consecutive number

Data Analysis: Framework analysis was used to analyze the data (23). The first step was familiarization with all of the transcripts. This required a thorough reading of all the transcripts and initial note-taking. The second step was developing a coding scheme to use to systematically code all of the data. Analytical axes were identified according to their respective codes, which, in turn, were grouped into key concepts. Some codes were empirical and theoretical based on what we would expect to see, other codes were developed based specifically on the research questions, while others emerged from the narratives of the interviewees themselves. Three researchers (two at INSP and one at Tulane) were involved in the analysis of the data and developed an initial coding list.

To ensure the understanding and the correct application of the codes, a joint coding exercise was undertaken. This involved each researcher independently coding one interview; the interview selected for this exercise was considered to be the most comprehensive. Once each researcher was done coding the interview, a line-by-line review of the interview was conducted to compare how each researcher applied the codes. Any discrepancies in coding specific passages were discussed until a consensus was reached. From this activity, certain points were clarified and a uniform criterion was established. Although there were pre-established codes, each researcher was also given the freedom to generate codes according to the interview results and the corresponding analysis axis.

To facilitate the work, the analysis was divided as follows:
» design and development of the EHR (planning and organization, criteria and requirements)
» implementation of the EHR (users, constraints, resources)
» EHRs impact (benefits, recommendations, vision for the future)

The third step in the analysis was indexing, or the systematic application of the codes to the interviews. NVivo 9.2 was used to code and analyze information. To the extent that the interviews were coded, it was determined that it was necessary to rearrange and group them in order to reach the goals set in the study.

The fourth step was charting, which involved reviewing all of the coded text by theme, codes, and by type of informant. The final step was mapping and interpretation. Each researcher was responsible for specific sections; these sections were then shared among the researchers for comment and revision.

A draft of the preliminary results was sent to two informants in Colima for review and comment.

Section 4   Results

This section presents the results from the in-depth interviews and FGD.[5] It is divided into the main themes that emerged from the analysis:

» actors and users of the HER;
» design, development, implementation, and maintenance of the EHR;
» use and level of implementation of the EHR;
» benefits of the use of the EHR;
» limitations and challenges; and
» recommendations to other states or countries who want to implement an EHR.

4.1   ACTORS AND USERS

Both individuals and institutions have been involved at various stages in the design and implementation of the EHR. The SAECCOL has been characterized as a "homegrown" tool developed according to the needs and characteristics of the state and its health units. It has been driven by individuals with varied professional profiles (doctors, engineers, planners, programmers, etc.) and experiences, interests and institutional affiliations. Some have had specific interactions for a fixed period of time, while others continue to interact with the program. SAECCOL actors and users include the following:

» **Directors:** Personnel belonging to the state administration appointed by the governor who has supported the initiative. These include the Secretary of Health and the Director General of the SP who have led the initiative and SS directors who have developed it. These were the driving forces behind the EHR initiative, responsible for allocating the necessary resources for its operation.

» **Technicians:** Responsible for collecting and incorporating the EHR requirements, with the help of users and national and international guidelines that must be met. They are responsible for implementing, training, supervising, and giving technical support to health units.

» **Health personnel:** SAECCOL consultants for development and end users. They include administrative and management personnel including doctors, nurses, and social workers of health centers. Administrators are associated with the EHR at each of the health centers or hospitals. Users are those who 'feed' the EHR, as they are the ones operating the electronic modules.

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[5] The direct quotes are presented both in the original Spanish and in the translated English since some of the quotations were difficult to translate.

» *Programa Oportunidades:* Program personnel were among the key enablers for the EHR development in response to the program's demands for information and the need to track its population health care. *Oportunidades* needs the data on its beneficiaries at the individual level in order to determine if its health is improving, and the national HIS only provides aggregate epidemiological and administrative data.

» *Seguro Popular:* This program provided the impetus for the development of SAECCOL due to its need for users' nominal information. The members' listings are provided with biometric markers, such as fingerprinting. It is a funding mechanism contributing to SAECCOL's development and currently promoting the creation of SINOS, which aims to link up with SAECCOL. It is also promoting the implementation of software and a care scheme called *Consulta Segura*, which seeks to alert users to chronic diseases such as obesity, diabetes, and hypertension.

4.2 DESIGN, DEVELOPMENT, IMPLEMENTATION, AND MAINTENANCE OF THE ELECTRONIC HEALTH RECORD

This section discusses SAECCOL's design and implementation process based on interviews with directors, technicians and system users, and other key actors.

4.2.1 Design and Implementation: Origins of the Electronic Health Record

The EHR in Colima began in 2004 under the General Direction of the SP, headed by the director of the Department of SP Affiliation. The director asked two information technology specialists to work on a prototype of an EHR. Informants involved in the design of the SAECCOL mentioned that they revi ewed existing EHR systems but did not find one that met their needs. Therefore, Colima decided to develop its own system. The design of the EHR was developed with the guidance of a working group made up of SS directives, information technology specialists, and consultants including doctors and system specialists, who understood that the EHR evolved out of the need to inform the SP (health attention costs and supplies), the improvement of health services, and the need for health information (availability of data for the federal health information system), with the objective to strengthen health care services for beneficiaries. As one informant said about the origin of SAECCOL:

> Spanish
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> …todo esto nace en la dirección del Seguro Popular, con el objetivo de fortalecer los servicios de salud para la atención a los afiliados… *Informático Estatal*

> English
>
> All this was born under the leadership of Seguro Popular, with the aim of strengthening health services to care for members… *State IT specialist*

An early version of the EHR was submitted to the Secretary of Health, who later approved it. First, the EHR designers prepared a prototype of the EHR to show the scope of the tool. This led to the decision to develop a second phase of the project, which would include the implementation of the EHR in all state health units.

However, there was no budget allowance for the project, which led to a slow-down in the implementation process. In addition, the EHR initiative was affected by several changes of administration in the SP and SS. This meant that they had to convince every new administrator of the importance of continuing support for the project.

Other informants, such as the directors at health centers and hospitals and FG participants, were unaware of the origin of the EHR in Colima, as many of them arrived at their health units after the implementation of SAECCOL. When asked why they thought an EHR had been implemented in Colima, many thought that the EHR resulted from national or state guidelines, or as a breakthrough in the use of information technologies applied to the health arena. Some informants said that Colima had the technological capacity to design its own system based on the IT capabilities of the local university, the University of Colima. For example one informant responded when asked why he thought Colima developed their own system:

> Spanish
>
> Hay unos antecedentes de tecnología de la Universidad de Colima, fue uno de los primeros lugares en que se inició algo en disco compacto, la escuela de telemática, la universidad una de las mejores al nivel nacional, hay mucha producción de gente muy hábil en esto de la tecnología. *Director Estatal*

> English
>
> There have been some great technological achievements at the University of Colima: It was one of the first places to work with compact disks, the school of information technology at the university is one of the best nationally. They produce highly qualified personnel in the area of technology. *State Director*

Other informants, however, believed SAECCOL was created in order to supervise health personnel.

4.2.2   Design and Development of EHR

A working group comprised of about 25 general practitioners, health specialists in various health centers, and computer personnel of the SS were invited to design the content and interface of SAECCOL. Meetings were held once a week in 2005 and bi-weekly in 2006. At these meetings, the experts discussed and provided feedback on the design, variable order, and module content. They reviewed all existing guidelines for each topic and would form consensus as to the way they wanted SAECCOL to operate.

The actual design and development of SAECCOL was the responsibility of the information technology experts from the SP, and they were in charge of incorporating improvements and suggestions to the EHR. In was key during this phase of the project to review all of the clinical record related guidelines, especially the NOM-168 and ICD-10. It was determined that one of the priorities of developing an electronic record was for it to comply with the above-mentioned guidelines, taking into account programs which had the greatest impact on the

population. Obtaining feedback from future users of the EHR was also a critical component of this phase. One informant shared:

> Spanish
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> …el área de diseño de la Secretaría de Salud nos comentaban, nos reunían y nos decían, a ver el expediente ¿qué debe llevar? La historia clínica, ok, la historia clínica lleva estos apartados y se lleva esto y esto. Entonces ellos iban, hacían su trabajo, nos lo traían y nos presentaban. Entonces nosotros ya les decíamos, ¿sabes qué?, esta ventana aquí no debe de ser, puede ser en otro lado; puedes aplicar un menú con esto, agrégale esto, así es más fácil. Esa era la manera. *Director Centro de Salud*

> English
>
> The designers from the Secretary of Health would come meet with us, talk to us and give us their comments after seeing the EHR. "What should it contain?" They asked. The records, ok, the health record has this and that. Then, they would go do their job, bring it back and present it to us. We would then give them feedback: "Do you know? This window should move from here to there. Maybe apply a drop down menu, add this or that, or this is easier." That's how it was done. *Health Center Director*

Initially, the EHR was designed to function specifically at the primary-level health centers and in the outpatient clinics of hospitals using the outpatient module. After the outpatient module was implemented, SAECCOL modules continued to be developed, including emergency, admission, and laboratory modules. It has also been updated according to changes in national guidelines.

4.2.3   SAECCOL Pilot

» After the initial design and development of SAECCOL, it was decided to pilot SAECCOL in two health clinics before implementing it throughout Colima. In November 2005, the EHR was piloted in two health units. The units were selected because they had the basic infrastructure (e.g., electricity and Internet) to install the EHR, as well as their proximity to Colima, and for their size. It was decided to use medium size health centers that had three consultation rooms, two nursing areas, records or archives, and a director. This would allow for all of the SAECCOL modules to be tested out. The directors of the two health centers selected for the pilot were also part of the working group that helped design the EHR.

» The profile of the physicians at each health center was different. One health center had mostly young doctors working there and they quickly became familiar with the use of the electronic record. The second health center, on the other hand, was comprised of mostly doctors who were older and less comfortable with computers. The comments and feedback from the older doctors was found to be extremely helpful in improving the EHR before it was implemented throughout Colima.

» During this period, there was an increase in the Information Technology team in charge of developing and implementing SAECCOL in Colima. It was at this time that a project coordinator for the EHR was appointed on a permanent basis.

4.2.4   Implementation

After the pilot tests had been conducted and necessary changes made, the implementation phase of SAECCOL in other health units and hospitals in the state began. The equipment procurement process was carried out in 2005 but the 300 computers did not arrive until 2006. This initial purchase of computers covered 80% of the health units. Once the equipment was available, installation and implementation of the EHR began.

The implementation process was gradual. The initial strategy was to install the EHR in medium sized urban health centers that had the minimum infrastructure standards required (e.g., electricity, wiring, Internet) to install the equipment. At the same time, all health units were provided with internal connectivity, a local network was established, and wiring of other health centers began. At this point, the SS IT Department provided support to the EHR in three areas: development, implementation (capacity building and monitoring), and technical support, all of which worked in unison to install the Outpatient Services module in primary and secondary level units.

Another major task was training administrative and health staff to use the EHR. Initially, this was done in large groups. The SS IT department was in charge of training personnel on the computers that would be used in the health units. The computers were then distributed to the health centers after the group trainings. As one health center director shared:

> Spanish
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> Inicialmente fue una sesión grupal. Asistimos varios médicos, era ir paso por paso, saber cuáles eran las funciones de cada una de las pestañas del expediente. Y cuando lo instalaron, pues inmediatamente, de manera rápida cubrí algunas de las dudas. Ya ahorita sobre la práctica ya va aprendiendo uno cuales son las funciones de cada pestaña. Pero si hubo una capacitación inicial en grupo. *Director de Centro de Salud*

> English
>
> At the beginning it was a group session. Several of us doctors attended. We took it step by step to understand what the functions of each of the windows in the electronic file were. And when it was installed, well, immediately, I helped with any questions there were [in the health center]. Now, as we use it more often, we learn as we go. We learn the function of each of the menus. Yes, there was a group session at the beginning. *Health center director*

These trainings covered the EHR users who were currently working at health centers, but it was necessary to also train the medical students. After finishing school, doctors have to perform community service for one year at the health centers or state hospitals before receiving their medical degree and continuing on with their residency. This type of physician is referred to as the *médico pasante*. Some rural health centers can be primarily staffed by *médicos pasantes*. Therefore, it was agreed with the University of Colima to train all doctors-in-training. As one informant shared:

La capacitación la hicimos en diferentes estrategias, fuimos a la universidad y pusimos, porque muchos son pasantes; ellos son mucho más fáciles, porque todos manejan bien la computadora. Entonces fuimos a la universidad, les llevamos el sistema del expediente, se los dejamos, y las primeras ocasiones nosotros íbamos y capacitábamos a los muchachos en dos días ya estaban capacitados, inclusive en un solo día y para que los muchachos que salieran de medicina ya trajeran el chip del expediente y cuando llegaran a su comunidad, ya no tuviéramos que volverlos a capacitar y todo lo demás… *Director Estatal*

Training was done at different levels; we went to the university and explained, because many doctors are still students. It was easier dealing with them because they all have a good understanding of computers. So, we went to the university, took the record system to them, and left it with them. At the beginning we used to provide training to the young doctors and in a couple of days they were ready to use the system, even in one day. We did this so that once they graduated they each had a file chip and when they got to their communities we didn't have to train them again… and start all over again… *State Director*

This ensured that the new graduates, who normally perform community service in health centers and state hospitals, have a basic understanding of how to operate the electronic health record, even before joining the workforce. This is critical for the health center directors who may get a new *médico pasante* every six months, since it saves them time if the resident doctors are already familiar with the EHR when they show up for service.

Due to the limited number of staff that could conduct the trainings, not all users were trained at the same time. EHR training was affected by constant staff turnover (mainly *médicos pasantes*) and by time constraints that resulted in some training sessions only covering the basics. An internal response by health units was to provide peer-to-peer training. Those who understood and knew how to operate the EHR helped those who did not. This is illustrated by one health center director who shared what happened after their initial training:

De ahí arrancamos y de ahí tuvimos supervisión constante y cercana para cualquier detalle, quizás entre nosotros mismos el que ya estaba mas avanzado en esto, nos fuimos apoyando y cuando no teníamos la gente que manejaba el expediente electrónico, siempre nos apoyábamos. *Director de Centro de Salud*

From there we took off and we had constant and close supervision for whatever detail, sometimes amongst one another through the most advanced among us, we went along supporting one another, and when we didn't have the people who managed the clinical record, we always supported one another… *Health center director*

Sometimes the users themselves took the initiative to learn more about the EHR. Other resources needed for the implementation phase were vehicles to transport personnel to conduct the trainings, adequate installations, and equipment distribution.

4.2.5 Maintenance

After 2005, the EHR project in Colima continued with an operating budget but without a maintenance budget, and without any indication by the state that it would endorse the continuation of the initiative. Given this, maintenance of SAECCOL was adversely affected. A few years after installation, some computers had outlived their usefulness, were broken, or not functioning optimally. There were no long-term technical support plans, supervision of users (to make sure they were using the EHR correctly) was not permanent, and training was interrupted temporarily. These factors soon undermined the EHR achievements as expressed by one informant:

> Spanish
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> …el proyecto ya nació, sin una normatividad, sin un techo presupuestal, ni un documento que lo sustentara…ya no hay una inyección financiera, y empiezan las computadoras a vencer su tiempo de vida. Se dice que una computadora vive de tres a cinco años de vida útil. Entonces empiezan las primeras computadoras a darnos problemas, no hay insumos, los vehículos no eran suficientes. *Informático Estatal*

> English
>
> …the project was born, without guidelines, a budget or a document to sustain it…it lacked an economic injection, the computers began failing and passed their point of usefulness. It is known that a computer has a life span of three to five years. Then the first computers started giving us problems, there were no supplies, and there were not enough vehicles. *State IT specialist*

In the meantime, state IT specialists continued to develop new EHR modules and content. Diagnostic lists were created, and an emergency module for hospitals was established including the CAUSES (Universal Catalogue of Health Services) list of the SP, laboratory applications, referrals and counter-referrals.[6] When it was time to update SAECCOL, it was discovered that not all health units were covered, that some had outdated versions, and that others had stopped using SAECCOL altogether.

Today coverage continues to be expanded and maintenance to the units is being performed, although due to the workload of the SS technicians, waiting times can exceed two months.

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[6] The referrals and counter-referrals are clinical-managerial procedures between health care units of different levels (primary to secondary care and vice versa) to facilitate the referral-reception-countereferral of patients.

4.3 SAECCOL STATUS

4.3.1 Coverage

In 2010, SAECCOL became one of the main priorities of the State Developmental Plan 2009–2015 (4). This again reinforces the implementation of the system in all health units. In 2011, new computer equipment was bought, bringing the number of health units operating SAECCOL to 57. This is roughly 50% of all health units in Colima and it is less than the peak of 80% coverage that was achieved earlier in the implementation of SAECCOL. It was expected that by late 2011, 99% of health centers and hospitals in the state would have SAECCOL. It is noteworthy that within each health unit, the degree of development and operation of SAECCOL varies according to the equipment, personnel, and infrastructure.

In regard to health centers, those located in rural or difficult to access areas have not yet implemented the EHR. Others however, are waiting for the latest version. Not all hospitals have the same modules; the modules used depend on specialties and services offered by each hospital. To improve the technical response capabilities, the number of technical support teams in each of the health jurisdictions was increased to support the health units at least every two weeks. The goal is to have an immediate response to requests or in the shortest time possible. At the same time, arrangements have been made for staff transportation, mobilization and distribution of supplies and equipment.

4.3.2 Use of the EHR in Health Units

Even in health units that have the EHR, paper records continue to be used as well as electronic records as there is still a need to do some health center functions with paper. The reasons for the use of both types of records include the following:
» A lack of trust in the EHR, mainly due to blackouts and computer failures.
» EHRs information may be inaccessible at times due to lack of printers, ink, or paper.
» It is useful to have information in hard copy.
» In some health units, such as hospitals, there are areas that have EHR and others that do not. There are currently EHR modules for outpatient services and emergency services, but if the patient has to be admitted into the hospital, the record has to be printed out.
» Obsolete SAECCOL (previous version) does not allow for the reporting of health information.

Due to the lack of inter-operability of the SAECCOL with other programs, users still have to provide information in paper form to their supervisors. One user said:

> Spanish
>
> y aparte, como mencionaban los compañeros, los supervisores requieren el registro físico de la mayoría de los programas y en el expediente electrónico no es tan fácil buscar lo que nos piden los supervisores *Participante de Grupo Focal, Centros de Salud*

There is no consensus on whether electronic or paper records are most suitable. Some participants think that the EHR is useful because it facilitates the work as related to the information management. Others consider the traditional method more appropriate because it allows them greater flexibility to manage health notes. Still, the physical file remains to comply with legal guidelines. Some SAECCOL forms must be provided in print as part of the consent to treatment process. In addition, all epidemiological surveillance is still done manually. There is a clear degree of overlap in some health units:

Spanish
Estamos alternando el método antiguo, con el método moderno que es el expediente electrónico, estamos duplicando trabajo y al final yo creo que si esta todo dentro de un expediente electrónico, pues es tan fácil como oprimir una tecla y sacar estadística. *Participante Grupo Focal, Hospitales*

English
We are alternating between the old and the modern method, which is the electronic record, we are duplicating work and in the end, I believe that it is all already in the electronic health record, because it is very simple to press a button and obtain statistics. *Hospital FGD participant*

In some health centers, they continue to use paper health records due to infrastructure deficiencies such as sporadic lack of electricity or computer problems. One informant commented that you have to attend to the patient one way or another even if the power is out. This resulted in the continued use of paper records in some health units that were also using EHRs.

The information reported by the EHR is incomplete and therefore personnel must resort to manual formats to fulfill some duties. This is because SAECCOL's design does not fully comply with the SS-required forms and those of other federal agencies that make use of this information. A common practice known as *paloteo* (manually tallying as one reviews each record) occurs between those who review health procedures. In some cases, they have no choice but to use physical documents as illustrated by the following quote from an informant:

Spanish
A nivel estatal y nacional todavía vienen a revisar tarjetones y a veces les decimos, mira aquí está el expediente electrónico, y a veces, como no tienen la habilidad del expediente electrónico, pues dicen ¡no!, yo quiero la tarjeta, lo quiero en físico. Cuando se tienen reuniones nacionales con Salud [a nivel federal], nosotros tenemos el expediente electrónico y nos dicen que debemos llevar una tarjeta, un tarjetero… *Director Centro de Salud*

At the state and national level, they still come to review the tarjetones (physical documents). We say: 'here is the electronic record' and because they don't have the system, they simply say 'no! I want the tarjeton. I want a hard copy.' When there are national health meetings (at the federal level), we have the electronic record but we are told that we need to have tarjetones… *Health center director*

Another reason health units have not been able to go completely digital has to do with the lack of an electronic signature for the attending physicians.

4.4   IMPACT OF ELECTRONIC HEALTH RECORDS IN COLIMA

Participants in this study agree that the EHR has brought many benefits to the provision of services. The main benefits described by participants fall into three themes: better organization of health services, ability to monitor the productivity of health units and health personnel, and improving health information availability.

4.4.1   Organization of Health Services

One of the main benefits of using SAECCOL is the improved organization of health services in the state. These benefits include better organization of schedules and appointments, saving time for patients and users, and the standardization of health procedures.

4.4.2   Health Scheduling Calendars

Most interviewees commented that one of the benefits of using SAECCOL was to organize the doctors' daily calendars. The SAECCOL allows scheduling patients, 30 minutes for a first visit and 15 minutes for follow-up visits. The result is that patients are seen in a more organized and systematic manner. This is beneficial to the doctor since their time is better managed, and it also benefits the patient and the health unit. The organization of the appointments means patients do not have to spend the day waiting for an appointment or a checkup.

Some of those interviewed reported that before the implementation of SAECCOL, the situation in health centers was chaotic, as the scheduling of patients was not done in a standardized manner. There were no set scheduled appointments at the health centers, but appointments were available at the hospital outpatient clinics. Patients would arrive in the morning when the health center would open and they would receive a number on a *ficha* (a chip with the number indicating the order in which they would be seen) and they would wait around until it was their turn. Patients were afraid of losing their place in line if they did not stay in the health facilities. Therefore, waiting rooms were completely full and sometimes people would have to wait outside. One interviewee recalled what it was like when visiting a health center before the implementation of SAECCOL:

Spanish

…estaba abarrotado de gente, esperando el inicio de la hora de poder sacar la ficha, estaban en el solazo, niños, madres, como un mercado. *Director Estatal*

English

..It was packed with people. They were waiting for the hour where they could request their turn, under the hot sun, children and mother, like an outdoor market. *State director*

One of the health center directors said that this overflow of patients in waiting rooms increased the overall stress in health centers that were already fully occupied providing services. Using SAECCOL allows health units to organize the physician's agenda, by date and time, and gives a patient an actual time for her or his appointment:

Spanish

Lo de la agenda está muy práctico, porque nos permite también estar nosotros mismos organizando los tiempos y ubicar al paciente, día y hora que le corresponde. Es más práctico que la agenda de papel. *Director de Centro de Salud*

English

The agenda is very convenient because we can organize ourselves, the time and place for the patient; the date and time she or he will be given an appointment. It is more practical than a paper agenda. *Health center director*

For the appointment system to work however, it was necessary to convince patients that the system worked and that they were going to be seen at the scheduled time. Health center patients were not accustomed to scheduled appointments, therefore it was necessary to urge patients to keep their appointments as established in SAECCOL. A health center director whose health unit had been one of the first users of SAECCOL said that during the implementation stage, they had talks with patients as they arrived in the morning to request their appointments. In these talks patients were reminded of the importance of keeping their scheduled appointments. One informant stated he considered getting patients accustomed to keeping appointments as a success for his health center. At the health unit level, organizing agendas improved productivity, as will be discussed further in the sections that follow.

Saving Time During the Health Appointment: Another benefit discussed by health unit directors and other informants from the state is that the use of SAECCOL saves time during the health appointment. One of the purposes of implementing the SAECCOL was to aid physicians in their work. However, according to all informants, this benefit was only achieved after physicians were well accustomed to using the EHR:

Spanish

ya teniendo la práctica los usuarios, algunos han manifestado que es más fácil, que más rápido pueden evolucionar en los datos que están registrando y es más simple que estar haciéndolo manual. *Director Estatal*

While the use of SAECCOL is supposed to save time during the medical
appointments and it is a benefit listed by the designers of the system and state
officials, there is disagreement among the actual of users of the system as to whether
or not it actually saves time. Some focus group participants believe that the use of
electronic records does not save time. However, health center directors and other
physicians who use SAECCOL during health appointments, feel the system does
save time and contributes to faster appointments:

The discrepancy noted above could be due to the physician's level of familiarity and
use of SAECCOL. Some physicians contend that, due to their health condition or
other risk factors, there are patients that require more time during an appointment
and that using SAECCOL will not speed up the meeting. In addition, some
physicians feel that the use of a computerized system makes the meeting between
patient and doctor less personal.

Standardization of Health Processes: Many informants agreed that using
SAECCOL standardizes health processes, which is an additional benefit. Several
interviewees commented that before implementing SAECCOL, records were
incomplete. Sometimes the health diagnosis was not written, there was no
background on the patient, and the notes were often impossible to read. Many
interviewees mentioned the doctors' handwriting as a significant barrier to accessing
file information. This is considered a significant problem as patients are seen by many
different doctors (*médicos pasantes* and other physicians in the same health unit); at
times the handwriting of certain doctors made patients health records illegible.

On SAECCOL the information is entered electronically allowing the next
physician who sees the patient to easily read the health record avoiding these
problems. SAECCOL also makes it easy for the doctor to complete all the required
information in a standardized way so that all diagnostics and prescriptions remain
the same. As one informant commented:

> Spanish
>
> … una guía que le recuerda al médico—¡Ah! tengo que llenar esto, ¡Ah! tengo que llenar aquello… *Informático Estatal*

> English
>
> It is a guide that reminds doctors—'Ah! I have to fill this. Ah! I have to fill that'… *State IT specialist*

Another informant stated:

> Spanish
>
> El mismo expediente te va guiando desde que abres la nota del paciente, te va guiando lo que tienes que ir llenando. Es como un pequeño acordeón que te va llevando de la mano para llenar todos los pasos. *Director de Centro de Salud*

> English
>
> The file itself guides you from the moment that you open the patient's note. It guides you from one screen to the next. It's like a small accordion file helping you fill all the steps. *Health center director*

SAECCOL does not allow the physician to skip steps, therefore building a more complete health record. This feature is great not only for patient care but also for the health unit, particularly for those health centers in rural areas that work with numerous *médicos pasantes*. The assignment of a diagnosis according to ICD-10, with all its limitations discussed elsewhere in this report, is another way in which health procedures are standardized.

4.4.3   Supervision and Monitoring

SAECCOL use has also facilitated the monitoring of physician and health unit productivity, which is considered a favorable factor emerging because of EHR implementation.

Monitoring Health Personnel: Another significant change reported by informants with the use of SAECCOL is the ability to monitor the work of the individual physician and health units. SAECCOL can provide information on the number of patients treated daily, the time the appointment begins and ends, drugs prescribed, and diagnoses made. It is possible to monitor the physicians and health units (i.e., tracking the diagnoses assigned and drugs prescribed) with paper medical records, but it is a more labor-intensive process that requires reviewing each medical record one-by-one and manually completing reporting forms. This process is sometimes complicated by poor hand-writing and a lack of uniform criteria (e.g., using brand names for prescription drugs versus the chemical names) used by physicians to complete each record. This can lead to great variability in the data that is reported by each unit. SAECCOL standardizes all these procedures and makes it easier to generate reports and produce information required to monitor health units and physicians. This standardization gives users more confidence in the data that is collected.

One example cited by some informants has to do with determining the length of each medical consultation. Again, it is possible to determine the average time a physician or health unit as whole spends with a patient, but some participants expressed a lack of confidence as to how accurate the information in the paper file actually is since each physician has to write down the time. One informant explains this as follows:

> Spanish
>
> Otra situación cuando era manual ponían la hora que querían, por ejemplo, igual al inicio o al cierre de la entrevista con el paciente; ahora está registrado automáticamente, en qué hora se está abriendo el expediente, que usuario lo abrió, etc. Y creo que las posibilidades de mentir son mínimas ¿por qué? porque también ahí pude calificarse la productividad del médico y sin tanto margen de error. *Director Estatal*

> English
>
> Another situation found is that in manual forms one could put the time one wanted. Sometimes, it was the same time at the beginning of the interview that the time the file was closed. Now the time is registered automatically. It records at what time the file is opened, which user opened it, and so on. I think the risk of lying is minimal. Why? Because now I can quantify the physician's productivity with less margin of error. *State director*

The ability to monitor the length of the appointment is beneficial on the administrative side; however, not all health professionals agree. Pressure to use the EHR has hampered work and created some problems. A participant in a focus group said that when he first began to use the EHR he forgot to open the record at the time he began the appointment, then, as he began to fill out the electronic form, it showed it was almost time to finish it. He then had to explain this situation when it looked like the appointment had only lasted five minutes.

The use of the EHR has also caused stress as doctors sometimes see it as a tool used to monitor and control them. They see the application to be more beneficial for administrators than for physicians. As one state level director said, doctors feel that there is always someone monitoring them through the use of the electronic system:

> Spanish
>
> Se sintieron los médicos dependientes de la computadora, supervisamos nosotros, supervisa el subdirector, supervisa administración… *Director Estatal*

> English
>
> Doctors felt blamed by the computer. We supervise them, so does the deputy director, the administration… *State director*

According to a health director, health supervision can improve the quality of service delivery because it generates information used to provide feedback to physicians:

…es un buen instrumento de registro para que en un momento dado platicar con el compañero médico y darle a conocer en que puede estar fallando o que se le puede estar olvidando para que el rectifique. *Director Centro de Salud*

English

It's a good recording instrument to be used when having a talk with a fellow doctor, to let him know what he may be failing to do or may be forgetting, so that it can be corrected. *Health center director*

Monitoring Health Units: Health unit managers need to analyze their processes and the use of EHR helps them do their job because all information is automatic and enables them to produce reports with more credibility. The EHR allows data analysis on physicians' productivity, but it can also process mortality and morbidity data and analyze data by age, sex, and type of disease, among others. The EHR also serves to monitor what medications the physician is prescribing. One informant said the information could be used to:

Spanish

…si se está prescribiendo de acuerdo al diagnóstico, de acuerdo a lo que nos indica también el Seguro Popular y todo el CAUSES, en relación también con el medicamento indicado para el padecimiento. *Director de Hospital*

English

…verify if prescriptions are being given according to the diagnosis. According to what we the Seguro Popular and CAUSES indicate, and to determine if it is the right treatment for the condition. *Hospital Director*

In addition to physician productivity, the EHR facilitates the supervision of health units in the state as a whole. This function is considered useful because it can be done at a distance, that is, oversight of the data does not have to be done physically at a health center or hospital:

Spanish

…pedimos aquí a los de sistemas que nos instale bien un expediente (el SAECCOL) para estar nosotros monitoreando las acciones de los que tienen línea, en aquellas unidades que tienen conexión. Por ahí hay una plataforma donde se está viendo de manera real o en tiempo real, se podría decir, lo que está produciendo la unidad en este momento, tanto de consulta, tanto de medicamentos recetados. Entonces en esas nosotros podemos monitorear las acciones que están haciendo las unidades y las acciones que no están haciendo pues nos sirve de práctica para estar con mayor actividad yendo a las unidades a hacer el análisis de los expedientes en el módulo del director que tiene cada unidad. *Director Centro de Salud*

…we requested IT staff to install a file (the SAECCOL) to monitor those units that have online access. There is a platform where you can see it in real-time, in other words, what is being produced in a unit at a given time, health appointments or drug prescriptions. Then, we can monitor those actions in the units and correct procedural gaps. It serves as good practice and helps us to be more pro-active, to analyze the units records in the director module. *Health center director*

4.4.4 Improving Health Information

EHRs use has improved the quality of health information available to all users. This information is used to make decisions regarding patient care and health unit organization.

Quality and Security of the Information: The use of EHRs can improve the quality and security of information available to physicians and managers, including patients personal data and information aggregated per unit. Data are available at any time they are required, or as one informant said:

Spanish

…disponible al cien por ciento, los trescientos sesenta y cinco días del año el expediente de la paciente. *Director de Centro de Salud*

English

…available one hundred percent, three hundred and sixty five days a year. *Health center director*

It is important for users to be properly trained to use the EHR. The quality of information is contingent upon users entering the data correctly. If the EHR is used properly, the quality of the information may be better than what can be obtained by filling out forms.

Respondents provided two main reasons why the use of EHRs is preferred over using physical records: fragility of paper records and added security of EHRs. There is an inherent fragility of paper records. They can become worn with time and use, lost or destroyed. One of the benefits of using SAECCOL "is that records don't get lost, notes are registered, nothing gets deleted" (Health center director).

Secondly, information saved in the EHR is considered safer because it has "a lock" that stores the data after a query. This means that details like the health notes, the time the appointment took place and the medications prescribed, cannot be changed or adjusted after a health consultation. This feature can protect the physicians in case there is any complaint about their services. As one informant shared:

> Spanish
>
> …esa es una gran ventaja para los servicios de salud, para los pacientes y para el mismo médico porque en el caso de una negligencia, ahora vamos a tener el expediente más completo y antes no. La historia clínica no la hemos revisado y se acabó y se perdió y ahora no se va a poder, no se ha perdido. *Director Estatal*

> English
>
> This is a great advantage to health services, for patients and for the doctors themselves because in the case of negligence, we can produce a complete record while before we couldn't. Before, health histories could get lost; now they can't, they don't get lost. *State director*

As mentioned in an earlier section, the EHR requires that the physician complete a full health history which provides more in-depth information as one informant said:

> Spanish
>
> El beneficio primeramente, para ver un paciente de primera vez, le haces un historial completo, saberlo aquí te sientes obligado a llenar todo lo que es el historial, desde antecedentes que conocemos de todo, lo familiar, el no familiar, todo el expediente lo completo. *Director de Centro de Salud*

> English
>
> The benefit is that when you see a patient for the first time you do a complete history, you feel compelled to fill out all of the forms, thanks to that we know the family history, the individual history, the entire file is completed. *Health center director*

A physician echoed this sentiment:

> Spanish
>
> Ahora tenemos una historia clínica más específica, más puntual, más sencilla…
> *Participante de Grupo Focal, Centros de Salud*

> English
>
> We now have a more specific history, timelier, simpler… *Health center FGD participant*

There is a sentiment that having complete, secure information can help users make better clinical and administrative decisions.

Information for Decision Making: Information can be used for patient and resource management decision-making. Doctors can make decisions for patients using information generated by the EHR. There is a more complete health history to make diagnosis easier. The EHR design requires that practitioners complete patient information in a more detailed manner, including complete health history and family data. The EHR provides steps to be carried out according to patient's characteristics and pathology:

> Spanish
>
> …está bien la opción estás haciendo tu nota y automáticamente registras, si es crónico, si es embarazada, está bien lo que es el control prenatal, ahí te va dando las semanas y todo, el inicio y el termino del embarazo… (Participante Grupo Focal, Centros de Salud)

> English
>
> …the option to make your notes and register if the patient has a chronic condition automatically is a good one. To note if the patient is pregnant; the prenatal care section is good. The system gives you the number of weeks and everything; the beginning and the end of pregnancy… (Health center FGD participant).

Having this information on hand can help physicians make decisions on how to treat patients. The EHR reminds doctors of the patient's clinical status and can reduce possible errors. For example, the EHR can guide physicians on what diagnostic tests to order and what medications to prescribe, as said by one informant:

> Spanish
>
> …con anterioridad el médico desplegaba una serie de pruebas y solicitaba, a veces, algunas pruebas que no eran tan necesarias para ese padecimiento. Y de igual manera nos va a venir a significar un ahorro muy importante, en la cuestión de medicamentos, porque de igual forma el médico se tiene que sujetar a la preinscripción, a lo que esté diciendo el catálogo; entonces no puede utilizar, por ejemplo un antinflamatorio, cuando a la enfermedad no le corresponde ese medicamento… *Director Estatal*

> English
>
> …before, the doctor used to display a series of tests and could ask for some that sometimes were not necessary for the patient's condition. There will be significant savings on prescription drugs, because the doctor has to stick to what has been pre-established, to what it is established in the catalog. For example, a doctor cannot use an anti-inflammatory when the drug is not used for that particular disease… *State director*

Health unit directors also commented that they are able to produce higher quality reports. They can use data provided by the EHR because patient review has been standardized. One health center director commented that now, for example, he can monitor how many diabetic patients in his clinic are being treated according to the guidelines.

Information for Resource Management: Another use of the information collected by the electronic system is for the management of resources at the health units and at the state level. Some interviewees commented that reliance on the information generated by the units was problematic before the implementation of the EHR:

Uno de los grandes problemas que tenemos las instituciones es la falta de confiabilidad, credibilidad en nuestras estadísticas; entonces, si no sistematizamos nuestros procesos, sino los automatizamos, no tenemos bases serias y suficientes para poder tomar decisiones asertivas. *Director Estatal*

English

One of the big problems we have in institutions is the lack of reliability, credibility in our statistics. So, if we do not systematize our processes, we do not have serious and sufficient basis for assertive decision-making. *State director*

Some informants felt that the EHR has improved the information available to managers and has helped them make management decisions or to request resources for the unit as shared by a hospital director:

Spanish

…yo tengo el cuidado de ver lo que yo produzco y también bajo las reglas de los indicadores de calidad, y con eso voy y me siento con más derecho de pedir mis necesidades al secretario… *Director de Hospital*

English

I am careful to look at what I produce and follow the quality indicators rules, and when I go to the Secretary I feel my demands are justified. *Hospital director*

At the state level, some informants said they used the information generated from SAECCOL to make purchasing decisions. One state-level director shared how he used information when it was time to buy medicines and it had not yet been determined how many units they needed to buy. The director said:

Spanish

Entonces yo le dije al Secretario, eso lo tenemos en una hora. Buscamos en el sistema nos dio como de doscientas mil consultas lo que habíamos registrado de estas personas, de medicamentos y así puede uno saber en primer lugar quien se los lleva y cuántos compra en porcentajes. *Director Estatal*

English

I told the Secretary, 'I'll have it in an hour.' We searched the system and it showed that two hundred thousand patients had been seen, how many drugs were dispensed, and thus we knew what we needed to buy. *State director*

4.5   LIMITATIONS AND CHALLENGES

Interviewees highlighted some critical factors which are barriers to the development and use of SAECCOL. The main limitations and challenges identified included: the use of ICD-10 for disease classification; discontinuity of implementation; system functions; lack of connectivity between different levels of care and with other systems; resistance to change; and insufficient training. These stated limitations and challenges mirror informants' recommendations for improving SAECCOL.

4.5.1   Disease Classification

The main complaint with SAECCOL concerns how diseases are classified using ICD-10. The disease classification application uses a default list of disease codes that physicians cannot fully use. This has resulted in physicians classifying diseases arbitrarily (any pathology that best resembles the observed is selected). In some cases, doctors recognize they have incorrectly filled this section but proceed to complete other modules of the EHR during the consultation. A feature that locks the EHR after the consultation ends adds to this problem since physicians wanting to go back and correct the diagnosis cannot do so. The following statements illustrate these frustrations:

Spanish

Me pasó muchísimas veces que no pudiera meter los diagnósticos y como no podías meter los diagnósticos, pues en uno de los apartados donde está la nota medica tú le escribías tú diagnóstico, por lo menos para que cuando se imprimiera apareciera el diagnóstico, pero no era lo correcto… *Director Hospital*

English

It happened to me many times that I was not able to write in the diagnosis and since I wasn't able to do so, I had to write the diagnosis in a separate box in the hopes that when it was printed, at least my diagnosis would show up somewhere in the form. But it wasn't the correct diagnosis… *Hospital director*

Spanish

Al principio lo más complicado pues era los diagnósticos porque están en lo que es la CIE-10 y a veces los muchachos o los pasantes eran los que a veces tenían los problemas, se les dificultaba un poquito ubicar bien el diagnostico. (Director Centro de Salud)

English

At the beginning the most complicated thing was the ICD-10 diagnosis. The younger guys, the residents, had the most problems with it. It was difficult for them to determine where to add the diagnostic. (Health center director)

Spanish

En el caso de nosotros, lo que hacemos, es imprimirlo con un diagnóstico lo más cercano y en donde dice análisis es donde estamos poniendo el diagnóstico verdadero, por así decirlo. Entonces así es como hemos estado funcionando… (Participante Grupo Focal, Hospital)

English

For us, what we do is print it with the closest diagnosis possible and where it says analysis, is where we put the true diagnosis, so to speak. So that's how we've been working… (Hospital FGD participant)

4.5.2 Problems with the Functions of the System

There were several complaints from users that dealt with other functional features of the system. Physicians feel that SAECCOL has partial functionality and does not allow flexible use (for example, health notes). Some think it is a flawed tool that hinders their work. There is a consensus among users that the EHR is "rigid." The disease classification also goes hand in hand with this difficulty. Other experiences shared by informants include the following:

> Spanish
>
> Si yo no guardo, por ejemplo voy a hacer toda la nota y a la hora que voy en esa opción le hago la opción de completar las recomendaciones o la dieta me marca error y tengo que cerrar la nota y todo lo que le escribí no se guardó. *Participante Grupo Focal, Centros de Salud*

> English
>
> If I do not hit save, for example, I will make all the notes and when I go to the option of 'complete recommendations' or the dietary options, it comes up as an error, and says I have to close the note, and everything I have written is lost. *Health center FGD participant*

> Spanish
>
> Es muy complicado poder llenar en un tiempo corto, porque también hay tiempos marcados para dar una consulta médica, todo lo que es un interrogatorio por aparatos y sistemas, todo lo que es una exploración física y todo lo que es un diagnóstico presuntivo, más la elaboración de la receta, la elaboración de las indicaciones y la captura de la próxima cita. Si esto lo ponemos en tiempo, nos llevaríamos más de treinta a cuarenta minutos por paciente, y si solamente hiciéramos la nota de consulta, estaríamos hablando de un tiempo de diez a quince minutos por paciente. *Director Hospital*

> English
>
> It is very difficult to fill in the form in a short period because there is a set amount of time to: give health advice, for the use of devices and systems, to conduct a physical check-up and make a presumptive diagnosis plus writing the prescription, for the preparation of the particulars and setting up the next appointment. If we put this in time, it would take thirty to forty minutes per patient. If we only did the health consultation note, we are talking about a period of ten to fifteen minutes per patient. *Hospital director*

Some users believe that the EHR was not designed for secondary level care. Some feel it only meets the first level of care specifications, and this can result in there not being specialized health diagnoses for use in a hospital, for example. As one informant shared:

Desde en un principio el expediente electrónico no era para un segundo nivel, parece que era para primer nivel. Entonces, muchas deficiencias en cuanto a diagnóstico, procedimientos que se tenían que hacer, no venían incluidos en su totalidad; eso era motivo de la problemática, de determinados diagnósticos que había que agregar en los apartados. (Participante de Grupo Focal, Hospitales)

English

From the beginning, it seems that the electronic record was not for the secondary level of care, it seems it was for primary level only. So, there were many deficiencies with the diagnosis, procedures that had to be done. They were not included in their entirety. The problem was that some of the diagnosis had to be done in added sections. (Hospital FGD participant)

Another limitation identified by users is having more than one record per patient. SAECCOL does not have a master patient list, which means that duplicate patient records can exist. It is not possible to follow up on patients through the EHR if there is duplication of records. Many of these problems are associated with the way their names are entered into the system and are mostly due to user error but can still add to frustration with the system. Some examples are illustrated below:

Spanish

A veces un paciente tenía hasta cuatro expedientes, ¿Por qué? Porque a veces los expedientes se extraviaban y se hacían expedientes nuevos para poder dar la atención médica, o porque no se escribía bien el nombre y no se encontraban los expedientes. Eso afectaba para darle continuidad a la atención al paciente, porque si un día llegaba y decía que ya lo habían atendido, pero uno no encontraba las notas clínicas de la atención pasada. *Participante de Grupo Focal, Centros de Salud*

English

Sometimes patients had up to four records. Why? Because records would get lost, and new ones were made to replace them so that the patients could get health attention; or because their names were spelled incorrectly and the file could not be found. Imagine the problem when the patient came in saying he had already received treatment but there was no indication of the last visit. *Health center FGD participant*

Spanish

Muchas veces nos encontramos con que hay dos expedientes de una misma persona, el típico ejemplo de las Marías. La señora se llama María Elena, ponen María Elena, pero vuelve a llegar a otra consulta y ponen Ma. Elena. Entonces abrimos ese y es como de primera vez o el caso de que ponen Gómez con z, Gómes con s, igual nos cambian todo y se pierde nuestro control… *Participante de Grupo Focal, Centros de Salud*

English

Many times we found there were two files for the same patient, the typical case with the 'Marias'. A woman is called María Elena, so she is registered as María Elena, but, in her next visit, they write, Ma. Elena. So a new file is created as if it was her first time. That is the same case with the 'Gómez'. Gomez, sometimes with Z; Gómes with an S. So everything changes and we lose contro. *Health center FGD participant*

4.5.3   Discontinuity in Implementation and Maintenance

The lack of continuity in the implementation process has been another major challenge. The EHR has been implemented in a fragmented manner between health units. This is due to the lack of financial resources and personnel, and administrative policy changes. Changes in leadership of the SS were also a challenge as there was often a need to convince key people of the value of SAECCOL. The lack of planned maintenance for the system, led to discontinuation of SAECCOL use in some health units as computers stopped working and were not repaired or replaced.

Spanish

La única desventaja no es más que el contar con el dinero suficiente para tener la cantidad del equipo suficiente y que estén en condiciones y que sean de la capacidad que se requiere en el servicio o en el hospital. *Director de Hospital*

English

The only drawback is not having enough money to have sufficient equipment that is maintained in the condition or capacity required by the service or hospital. *Hospital director*

4.5.4   Resistance to Change

Another challenge identified by informants was the general resistance to change among some users. Some stakeholders still do not believe that the EHR is a useful tool and therefore preferred to continue recording the patient's history in paper files. The study indicated that older health care staff in Colima are not adept at managing new information technologies. Before being trained in the EHR, many doctors had to be instructed in the use of computers.

Spanish

Habíamos ya algunos médicos que no queremos, de cierta edad, que no queremos utilizar el expediente porque no sabemos utilizar la computadora. *Director Centro de Salud*

English

There were a few of us, of a certain age, who did not want to use that technology because we don't even use computers. *Health Center Director*

Some informants believe that certain personality types will always be resistant when presented with new procedures. Convincing physicians of the importance of using SAECCOL was noted as one of the areas requiring particular attention.

4.5.5   Insufficient Training

Another limitation mentioned was the lack of sufficient training and follow-up. There is ongoing training for new staff entering health centers and hospitals using SAECCOL but many still feel this is not enough and there should be more regularity in training. Often professionals train themselves, and this possibility is limited with the EHR. As one state director said, "Training is not so simple. You need to be reinforced, visited, supervised."

4.5.6   Poor Infrastructure

The implementation and continued use of SAECCOL was hindered by infrastructure problems as well as an insufficient number of computers or computers which were outdated or obsolete. Some health centers do not have electricity or Internet access, or their facilities are in poor condition. This continues to be a major challenge for the use of SAECCOL.

4.5.7   Other Limitations and Challenges

Other challenges identified include the non-use of data that are collected, dependence on the state after the adoption of SAECCOL, and lack of coordination at the local, state, and federal level. So far, the EHR has served to organize health services and standardize health processes; however, the data from it have not been consolidated. Unfortunately, no SIS report is entirely generated from the EHR. At this point, SAECCOL is being underutilized.

> Spanish
>
> Hay muchos programas que maneja la Secretaría, que nos están pidiendo información en forma separada, a cada uno, y que no la pueden sustraer del expediente electrónico. *Participante de Grupo Focal, Hospital*

> English
>
> There are many programs managed by the Secretary of Health that request information separately which cannot be obtained via the electronic record. *Hospital FGD participant*

The health units' SAECCOL equipment and technical support depends on the state office of information technology. This has meant that there is no autonomy within health units to settle their own affairs. None of the health centers have their own IT unit or enough computer equipment to meet their needs. This dependence on the state for support has added to the frustration with using the system:

Hasta hace nueve meses, diez probablemente, no teníamos una persona de sistemas; este hospital no tenía un encargado de sistemas; entonces cada vez que necesitabas alguna situación para corregir cualquier máquina, había que llamar a Colima. *Director Hospital*

English

Until nine or ten months ago, we did not have an IT person, this hospital did not have an IT manager. So every time you needed to correct a situation, any machine, you had to call Colima. *Hospital director*

Although the EHR is based on national guidelines, there is no real articulation of SAECCOL at the local, state and federal levels. Each center has its EHR but they are not connected with each other, and there are no ties between the federal and state level, beyond compliance. As mentioned above, the use of both manual and electronic records is common in health units, which, in some cases, doubles the workload for those responsible for filling out forms.

4.6 EXPERIENCES TO SHARE

4.6.1 Suggestions to Other States or Countries

Participants had different experiences to share with other states or countries interested in implementing an EHR in their health units. Suggestions can be categorized according to the following:

» user training
» resource investment and system maintenance
» teamwork
» pilot testing

User Training: The use of an EHR brings multiple benefits to the health system, patients and users. However, to ensure effective use of the EHR it is necessary to train users in EHR management and in computer skills from the beginning of the process. Skill level is not uniform among all participants, and therefore instruction in the EHR should be an ongoing process. Some interviewees commented that the training they received was not enough and this generated resistance to using EHRs. A participant in a focus group said they did not receive formal training but rather learned by "prueba y error" or "trial and error." A number of interviewees stated that they felt neglected after the initial training and could have used more supervision when they first began using the EHR, as one informant shared:

Spanish

…los que nos dieron la capacitación el expediente, nada más lo vimos esa vez y conmigo han ido dos veces en todo el año, entonces si sería bueno que fuera un poquito más seguido. *Participante de Grupo Focal, Hospital*

We only saw those who trained us on the electronic record, one time. Since then, I have seen them once throughout the year, so it would be good to train a little more often. (Hospital FGD participant)

In other situations, users complained that the training was too brief for all of the information they had to learn. But informants who were on the training side commented that it was difficult to estimate the time needed to train a given unit:

Spanish

¿cuánto tiempo ocupas para hacerlo? Multiplicamos el tiempo que duras en capacitar a una persona por la cantidad total y ese es nuestro resultado. ¡Eso no es así, no es lineal, no es proporcional en las cuentas! *Informático Estatal*

English

How long do you take to do it? Multiply the time it takes to train one person by a given number of people, that should be the answer. But, that is not how it is! It is not linear, it is not proportional. *IT specialist*

Therefore, it is important for future scenarios that time be allocated for initial and ongoing training to ensure that users are comfortable using the EHR and use it well.

As seen in other parts of this report, resistance to technology exists and constitutes a barrier to implementation of EHRs. Several of those interviewed think that doctors are the most resistant to using new tools and there has to be an appreciation of how much the practice of medicine has changed for them. Most health units are made up of doctors of different ages, with different abilities and skills in the field of computing. Some informants felt that it was also necessary to provide basic computer training in addition to training physicians on how to use the SAECCOL.

Spanish

Entonces creo yo que habría que entrarle a capacitar, aun brevemente, a las personas que no están acostumbrados a ser cibernéticos, que no están en la computadora. *Director Hospital*

English

I think it is necessary to train, at least briefly, the people who are not used to cybernetics, those who don't use the computer. *Health director*

Some informants also felt it was advisable for the trainers to be physicians as well. Trainers should know as much about medicine as computers:

Spanish

…a mi compañera, quien la capacito, la capacitó gente de sistemas, gente que sabía el movimiento de computadoras, pero que nunca ha dado una consulta. Fue gente que sí elaboro muy bien cada punto, cada detalle, pero que omitió explicar, ya en el momento de capacitar al médico, omitió explicar algunos detalles importantes en lo aplicativo o en lo clínico. *Director de Hospital*

English

…Who trained my colleague? The IT people. People who know how computers work but who have never given a health appointment. They explained every point, every detail [of the system], but failed to explain important details in its clinical application. *Hospital director*

Another recommendation is to have a multidisciplinary training team. It is important to train the director of the health units to use the EHR, as sometimes administrators do not know all the applications themselves. This is illustrated in the quote below:

Spanish

Y la otra parte que a mí me gustaría es que a través del expediente electrónico yo pueda sacar datos estadísticos que me permitan decir: cuántas pacientes vi, cuántas eran mujeres, cuántas eran hombres, qué diagnósticos fueron los que vi. Quiero suponer que eso se hace, o por lo menos creo que eso puede hacer el expediente, solamente que a la fecha yo no tengo ni la más mínima idea de cómo es. *Director Hospital*

English

What I would like to get from the electronic record are statistics that would allow me to say how many patients were seen, how many were women, how many were men, which diagnoses were given. I assume this can be done, or at least could be done with this record, but to date I have no idea how to do it. *Hospital director*

Resource Investment and System Maintenance: The implementation of an EHR system requires many resources—financial, physical and human—and therefore it is necessary to plan and provide input for the project. This also requires the political will of those who direct initiatives of this magnitude:

Spanish

…lo económico, que es bien importante porque, pues podemos tener, a lo mejor, toda la intención, tener ya el sistema; pero los equipos no tenerlos, las máquinas, que es lo que nos sucedió a nosotros. *Director de Centro de Salud*

English

…the economic part, it is very important because we can have the best of intentions, have the system, but not have the equipment, the machines… which is what happened to us. *Health center director*

The resource requirements include having a budget to ensure there is enough equipment in all units, a team dedicated to training, technical maintenance of the EHR, and ability to develop or purchase an EHR program for use in health units. Some interviewees complained that there was not sufficient budget to maintain SAECCOL, especially in relation to computer equipment which is not designed to last more than four or five years. All health units should have sufficient equipment (computers, printers, LAN, paper, toner, etc.) to use the EHR but this was not

always the case. For example, one hospital director told the interviewers that he had to use computers from the administrative offices in order to have enough computers in the examining rooms.

It is not enough to spend money on purchasing equipment to start the project. There must be a maintenance budget in order to replace non-serviceable equipment or repair items associated with the EHR. A focus group user told investigators how he had to bring his own printer to the health center because the printer was broken when he arrived and was never repaired. It is also necessary to provide ongoing support to the units, which should be part of planning. As a hospital director said, it is important to know:

Spanish

…quienes van a implementar el del expediente, mantener el expediente, actualizar el expediente y corregir las fallas del expediente. (Director de Hospital)

English

…who will implement the system, keep up the records, update the files and correct the flaws found in the electronic record. (Hospital director)

Teamwork and Collaboration: All participants felt that having a multi-disciplinary team of health and technical experts design and develop SAECCOL was an important factor in Colima. Focus group participants recognized that teamwork is the key to success in the EHR. This includes requesting assistance from other states that have implemented the EHR and multidisciplinary involvement in the process.

Technology has changed a lot since Colima decided to develop and implement EHRs. Several interviewees think that acquiring a new system would not be necessary; instead, they could adopt an already existing system and adjust it to the individual needs of each state or country.

Another point made by some participants is that system changes will inevitably be met with some user resistance and it is therefore necessary to redouble efforts to train users on the potential benefits of the EHR. In Colima, it was found that physicians who were at first skeptical of the SAECCOL, later became competent users of the system and contributed the most to its development and improvement. As one hospital informant shared:

Spanish

uno de los médicos que debe de tener unos 25 años ya de servicio y él no usaba la computadora y ahí empezó con muchas dificultades y ahora lo usa muy bien. *Director de Hospital*

English

One of the doctors who must be a 25-year veteran had never used a computer and started with many difficulties; now he uses it very well. *Hospital director*

One focus group of users who had been using the system for a relatively long time said they would tell their other colleagues not to give up on the system and not to get frustrated when they start using it.

Piloting: Another recommendation emphasizes the importance of a pilot before fully implementing the EHR. This is necessary to ensure that everything works well and that the necessary modules are well implemented. This is particularly important when using an existing EHR or developing a new electronic record as was the case for Colima.

4.7   RECOMMENDATIONS TO IMPROVE SAECCOL

All of the informants were asked to offer recommendations on how to improve SAECCOL and their responses mirror some of the issues raised in previous sections.

The main recommendations are to:
» Improve the area of diagnosis categorization by either allowing an open-ended diagnosis or increasing the number of diagnoses to improve access by secondary level users;
» Integrate SAECCOL with other systems;
» Continue to improve SAECCOL to make it more flexible, allowing for referral and counter-referral, etc. ;
» Incorporate more health areas like dentistry, psychology, AIDS, and pediatrics into the SAECCOL; and
» Provide more technical support to users.

Section 5   Discussion

The purpose of the study was to assess the development and implementation process of SAECCOL, its perceived benefits and limitations and to make recommendations to improve the system and implementation process. Our results show that the main driving force behind the design, development and implementation of SAECCOL was the strengthening of the reporting capabilities for the *Seguro Popular* and *Programa Oportunidades*, two of the main programs to improve health and social development in Mexico. The decision to design and develop the EHR to meet information-reporting requirements of the SP and federal health information systems affected the potential for the EHR to influence the quality, efficiency, and cost of health service delivery. The collaborative effort of physicians, hospital administrators, IT specialists, and state officials participating, was fundamental in the design and development process. The University of Colima was instrumental in the decision for an EHR "homegrown" development strategy. As a result and in spite of its reporting focus, physicians saw benefits from improved data availability, to a better understanding of their patient's history, and reduced medication errors. However, these benefits fall short of the potential of the EHR to improve quality of care.

The Colima Secretary of Health was able to take advantage of the information needs of important health programs to secure funds for the initial investment in development and implementation of the EHR; this proved to be a very successful strategy. The implementation process was phased and systematic, with appropriate attention to infrastructure requirements, and with an effort to involve stakeholders and generate support for adoption by the health workers. From our perspective, this is a highly recommended best practice. However, there were several significant challenges to the success of the EHR. First, physicians are concerned that the EHR was designed primarily to evaluate their performance. Physicians also felt strongly that coding ICD-10 diagnoses is a clerical function being forced on them through the EHR and should not be part of their medical practice (22). Introducing performance monitoring as part of the culture of information, and a tool for soliciting organizational feedback, may positively influence the way physicians perceive and react to EHRs monitoring capacity. Additionally, as ICD-10 coding is needed for the standardization of the collection and reporting of EHR data, non-compliance is not an option. Nevertheless the efforts of the IT department to further develop the functionality of this classification scheme may improve the experience of physicians. Another solution to this controversial aspect of the SAECCOL would be to let the doctors annotate the unclassified diagnoses and have a group of specialized coders do the coding at a later time.

Another factor that put at risk the sustainability of the EHR was the lack of an information policy and normative framework at the time of the design and development, which impeded the ability to promote governance and to negotiate for operating funds. Our results also show that the initial investment was not accompanied with the subsequent funds to maintain the EHR software, the IT infrastructure and to provide adequate training. This led to a decline in the use

of the EHR to nearly half of the initial level. Given that coverage never reached 100%, it was necessary to use a combination of paper based and EHR files to meet the SP information requirements, resulting in additional time spent on data processing. In response to lack of training, they engaged the University of Colima to provide training in the use of the EHR, to medical students and incorporating the EHR medical curriculum. The present administration incorporated into the State Development Plan the use of the EHR as the official health information system in the SHS managed health clinics and hospitals. This has given SHC the necessary leveraging power to negotiate with SP and *Oportunidades* the use of SAECCOL as the sole information system, and to get the necessary funds to ensure 100% coverage, as well as operating costs, instead of having to use the parallel SINOS system.

The implementation of an EHR in the public health sector is subject to multiple pressures and requires a vast amount of financial and human resources. Operating funds are required to ensure sustainability, but more importantly, political commitment. This must be expressed in a state or national strategic plan in order to withstand administrative/political changes. The authors are well aware that most public institutions do not follow or adhere to such a process. Colima did not begin with a clear strategic plan but rather was responding to information needs of funding agencies; nevertheless, Colima was able to recover midway with the new administration. This was a lesson learned the hard way.

Ideally, the strategy to move towards an EHR at the state or national level should be part of a national strategic plan. This promotes ownership, builds capacity to meet information needs in order to advocate for funds and thus avoids creation of parallel systems. The evidence from Colima, highlights the importance of including stakeholders at the planning phase in order to address their specific information needs (23). Just as important, sharing of experiences within a country and south-south collaboration can improve the chances of successful implementation, scalability and sustainability. It is imperative that funders recognize the potential synergies of their investment in health information systems and technology as a way to promote: diagonal effects with positive spillover effects to other health problems beyond the intended programs.

5.1   SCOPE AND LIMITATIONS OF THE STUDY

This study corresponds to an EHR case study in Colima, Mexico; therefore, the results apply only to the context in which they were developed. The fieldwork was conducted between August and November 2011. Some limitations of the study include the following:

» It was not possible to make a clear distinction between early-adopting health centers and hospitals and those recently adopting as initially planned. This occurred because most of the health units had used the EHR at some time in the past, although in some cases it was not being currently used.

» There is no direct link between the federal (DGIS) level and the state with respect to the EHR, which hampered the implementation of the interview instruments.

» There is no use of information by the SP at the federal level and therefore it is not connected to the SAECCOL. SP currently leads the SINOS program and its features, objectives and functions differ from the EHR. In this case, questions about the design and implementation of the SINOS program were asked instead.

» It was not possible to interview *Oportunidades* staff at SEDESOL, since they have no connection with the EHR in Colima and the program is not directly associated with SINOS. Instead, two professionals of the Directorate of Opportunities, from the National Commission on the Protection of the Health Systems—CNPSS, in Spanish—were interviewed.

Section 6 Conclusions

In light of the results obtained through interviews with personnel involved in SAECCOL in Colima, the following conclusions were reached:

» The EHR was developed to meet the state's needs and was adjusted according to operational and normative requirements. This has involved working together extensively with professionals from different areas to determine and agree on the guidelines for a functional tool. To ensure the success of the EHR, participation of all actors associated with the application is indispensable. This is not meant to impose a new resource on the health units, but to build a new tool by carefully listening to everyone's interests and expectations.

» Inter-institutional aid was pivotal to meeting the needs of the EHR. The case of Colima highlights the support of educational institutions for the training of health interns, who graduate with basic knowledge in SAECCOL management. It also highlights the cooperation of health units with the central administration.

» The work of the EHR is an ongoing process that should not be interrupted. Resources are required in order to ensure the success of its development including: human, financial, physical and technological. This implies a strong commitment from the government to ensure the continuity of the project in the medium and long term. In this respect, the state of Colima has made great progress, as SAECCOL is included in the existing *State Developmental Plan* as one of its pillar programs (4).

» This experience can be taken into account by other states in Mexico and by other Latin American countries wanting to carry out a project similar to the one in Colima. However, one must consider the complexities of each context as well as the requirements for the implementation of the project.

» The EHR is a tool that can help improve the quality of health services in general; however, it is not the universal solution to all problems facing health personnel. Therefore, the EHR is a means, not the end.

» Since health personnel have different abilities and skills, training is essential for the management and operation of the electronic record. Furthermore, it is essential that health personnel, especially older staff, receive basic computer management courses. Sometimes the use of EHRs is hampered by the user's reluctance and by the lack of education in technology among health professionals. This process must be ongoing to ensure that new staff joining the centers and hospitals will be able to fulfill the functions assigned to them.

» The implementation of the EHR involves medium- and long-term maintenance. It should be noted that the EHR operation depends on follow up and feedback, maintenance for computers and technical support teams.

» Participants in focus group interviews emphasized the importance of the pilot program phase. This is one of the stages which merits special attention, as it is a prime opportunity to enhance and adjust the tool.

» The strengthening of EHRs occurs on several fronts. However, its current aim is to achieve interoperability (between units at different levels of care, between health units and the central level and between the state and federal levels), as well as meeting the requirements established by NOM-024.

» To date, the EHR is not articulated between federal and state levels, which is necessary to validate the instrument and ensure its interoperability with other states in the country.

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Annex 1 In-Depth Interview and Focus Group Discussion Guides

A1.1 INTRODUCTORY SCRIPT

Thank you very much for meeting with me. My name is [NAME] and I am a researcher with the National Institute for Public Health (INSP) here in Mexico.

As you have been informed, we are conducting a study of Electronic Health Records in Colima. More specifically, we are studying the SAECCOL (*Sistema Administrativo del Expediente Clínico de Colima*-Administrative EHR System), which has been implemented in some of Colima's public hospitals and health clinics in order to improve various aspects of health system functioning. This study has been funded by the United States government, and is being conducted by researchers at INSP, Tulane University and the University of North Carolina in the United States. We are interested in learning about a number of issues to help us better understand how well the system is working. For example, we would like to know more about the characteristics of the SAECCOL, how the system is being used, and how the system might be improved.

The results of the study will be used to provide an assessment of the benefits and limitations of the SAECCOL, recommendations for improving the system, and recommendations for other states in Mexico and countries in the Latin American and Caribbean region. This helps to ensure that EHRs interventions are appropriately designed and implemented to improve health systems functioning and resulting EHR information is used more effectively.

Your participation in this interview will help us towards this goal. I have an informed consent form here that provides information to help you decide whether to agree to take part in this study. This includes information on confidentiality and privacy, an explanation of the study and its procedures, and the terms of your participation. We will ensure that information you provide during this interview will be kept confidential.

Please read carefully through this consent form. I will wait and answer any questions that you may have.

Provide consent form, address any questions, and check whether the person consented to being recorded. If person consented to being recorded, ask:

I will now start recording the interview. Later, we will transcribe the interview.

Check to see if informed consent box is checked.

Do you have any other questions before we start? If you have questions during the interview, please do not hesitate to ask.

A1.2   INTERVIEW QUESTIONS

1. Can you tell me about your work experience in the health system in Mexico?

   Probe for where worked, position, what organization(s) worked with, which years worked there, job responsibilities.

2. Can you tell me about your experience with the SAECCOL?

   Probe for what roles they have played, including experience in designing, implementing, and using SAECCOL, and in producing and using information from the system.

3. Before SAECCOL was introduced, could you tell me how data was collected and used?

   Probe for roles and routines of various stakeholders (doctors, facility managers, state actors) in the pre-SAECCOL situation.

   Probe for why SAECCOL was designed and implemented in Colima.

4. Did you or others in your organization have a role in the design and implementation of SAECCOL? If so, how?

   Probe about whether they or others in their organization were consulted about data that should be collected, how the EHR should look and feel, including menu choices, data reporting, and so on.

   Probe for involvement in implementation (was system phased in or implemented all at once, were they given additional resources for learning how to use system, and how much were they consulted on these kinds of things.

   Probe for a discussion of how the system might have changed the way they do their work.

5. What is the current state of adoption of EHRs in clinics and hospitals?

   Probe for whether system was installed and where.

   If installed, probe for how system is being used: who (all doctors, some doctors), how much (how many of the functions are being used), how often (some of the time, all of the time).

6. What have been the benefits of the SAECCOL to you and others in your organization?

Probe for whether data and information is available and being used to improve health services—quality of care, efficiency in the use of resources, etc.

Probe for how the system has changed their job for better or worse.

7. What have been the problems and limitations of the SAECCOL?

   Probe for issues related to the ICD-10.

   Probe for any issues in meeting the needs of federal programs and other organizations.

   Probe for any conflicts or tensions between the respondent and others either within their organization, or between their organization and other organizations at any level.

8. What lessons have been learned from the SAECCOL experience in Colima that might be generalized to other states in Mexico and to countries in the region?

   Probe for recommendations for improving design, implementation and functionality both in Colima and other states.

A1.3   CLOSING SCRIPT

That is the end of this interview. Thank you very much for taking the time to do this interview with me. Your knowledge and experience working in the health system will be truly helpful to us to better understand the effectiveness of the Electronic Health Records in Colima, and to ma ke improvements in the system in the future.

Would you like to see the transcript of your interview after it has been transcribed?

   If the person wishes to see the transcript, say:

We will start working on the transcription after the interviews have been completed. We can email your interview transcript once it is ready. What email address would you like us to use?

Thank you again for your help with this study. We look forward to being in touch.

Annex 2　Focus Group Discussion Guide

Colima SAECCOL Focus Group Guide Outline
INSP, Tulane, and UNC Evaluation Team, July 2011

Focus Group Logistics	TBA
Names of Focus Group Team	Facilitators: [NAMES]
Study Title	Electronic Health Records in Mexico: A Case Study of the Experience in Colima

A2.1　FACILITATOR'S INTRODUCTION

Welcome and thanks to you all for coming today! My name is [Name] and this is [Name other person]. We will be your group facilitators.

As you have been informed, we are conducting a study of Electronic Health Records in Colima. More specifically, we are studying the SAECCOL (Sistema Administrativo del Expediente Clínico de Colima-Administrative EHR System), which has been implemented in some of Colima's public hospitals and health clinics in order to improve various aspects of health system functioning. This study has been funded by the United States government, and is being conducted by researchers at INSP, Tulane University and the University of North Carolina in the United States. We are interested in learning about a number of issues to help us better understand how well the system is working. For example, we would like to know more about the characteristics of the SAECCOL, how the system is being used, and how the system might be improved.

The results of the study will be used to provide 1) an assessment of the benefits and limitations of the SAECCOL, 2) recommendations for improving the system, and 3) recommendations for other states in Mexico and countries in the Latin American and Caribbean region. This helps to ensure that EHRs interventions are appropriately designed and implemented to improve health systems functioning and resulting EHR information is used more effectively.

Your participation in this focus group will help us towards this goal. I have an informed consent form here that provides information to help you decide whether to agree to take part in this study. This includes information on confidentiality and privacy, an explanation of the study and its procedures, and the terms of your participation. We will ensure that information you provide during this focus group will be kept confidential.

Please read carefully through this consent form. I will wait and answer any questions that you may have.

Provide consent form, address any questions, check whether the person consented to being recorded. If person consented to being recorded, say:

Check to see if informed consent box is checked.

Do you have any other questions before we start? If you have questions during the interview, please do not hesitate to ask.

After signatures have been collected, say:

Do you have any other questions before we start? If you have questions during the interview, please do not hesitate to ask.

A2.2   FOCUS GROUP QUESTIONS

1. Can you tell me about your work experience in the health system in Mexico?

   Probe for where worked, position, what organization(s) worked with, which years worked there, job responsibilities.

2. Can you tell me about your experience with the SAECCOL?

   Probe for what roles they have played, including experience in designing, implementing, and using SAECCOL, and in producing and using information from the system.

3. Before SAECCOL was introduced, could you tell me how data was collected and used?

   Probe for roles and routines of various stakeholders (doctors, facility managers, state actors) in the pre-SAECCOL situation.

   Probe for why SAECCOL was designed and implemented in Colima.

4. Did you or others in your organization have a role in the design and implementation of SAECCOL? If so, how?

   Probe about whether they or others in their organization were consulted about data that should be collected, how the EHR should look and feel, including menu choices, data reporting, and so on.

   Probe for involvement in implementation (was system phased in or implemented all at once, were they given additional resources for learning how to use system, and how much they were consulted on these kinds of things.

   Probe for a discussion of how the system might have changed the way they do their work.

5. What is the current state of adoption of EHRs in clinics and hospitals?

Probe for whether system was installed, and where.

If installed, probe for how system is being used: who (all doctors, some doctors), how much (how many of the functions are being used), how often (some of the time, all of the time).

6. What have been the benefits of the SAECCOL to you and others in your organization?

   Probe for whether data and information is available and being used to improve health services—quality of care, efficiency in the use of resources, etc.

   Probe for the system has changed their job for better or worse.

7. What have been the problems and limitations of the SAECCOL?

   Probe for issues related to the ICD-10.

   Probe for any issues in meeting the needs of federal programs and other organizations.

   Probe for any conflicts or tensions between the respondent and others either within their organization, or between their organization and other organizations at any level.

8. What lessons have been learned from the SAECCOL experience in Colima that might be generalized to other states in Mexico and to countries in the region?

   Probe for recommendations for improving design, implementation and functionality both in Colima and other states.

A2.3   CLOSING SCRIPT

That is the end of this discussion. Thank you very much for taking the time to do this focus group. Your knowledge and experience working in the health system will be truly helpful to us to better understand the effectiveness of the Electronic Health Records in Colima, and to make improvements in the system in the future.

Would you like to see the transcript of this discussion after it has been transcribed?

   If any person wishes to see the transcript, say:

We can email you the transcript once it is ready. What email address would you like us to use?

Thank you again for your help with this study. We look forward to being in touch.