

Practical Use of ACSiS to Strengthen National Disease Management Programs

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Table of Contents

Acknowledgment and Endorsement	3
Executive Summary	4
Organization Profile.....	5
1. Introduction.....	6
2. Internship Work	7
2.1 Getting to Know ACSiS Functionality	8
2.2 Developing the Documentation	10
2.2.1 Purpose and Audience.....	11
2.2.2 Linking ACSiS and Disease Management Programs	11
3. Delivery of the Documentation.....	16
4. Health Informatics and the Use of ACSiS for Disease Management	16
5. Challenge	17
6. Conclusion	19
7. Recommendation	19
8. References.....	21
APPENDIX A: Snapshot of ACSiS	22
APPENDIX B: Key Indicators Calculated by ACSiS.....	23
APPENDIX C: Accomplishment Letter.....	28

Acknowledgment and Endorsement

This report has been written by me and has not received any previous academic credit at this or any other institution

I would like to thank the following persons who made this internship a success:

Tristan Rutter, CEO of Populus Global Solutions Inc who did a presentation on ACSiS as an encounter-centric Health Information System solution for developed and developing countries that sparked my interest in working with the system.

Jeff Beairsto, director of quality solutions who introduced me to the system and worked me through the different modules of the software.

Calvin Pert, director of delivery who I worked with almost every day developing the documentation that was the object of my internship.

Dr. Michael Graven, the one without whom this internship would not have been possible.



Gabriel G. Thompson

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Date

Executive Summary

The information required to determine health needs, the delivery of services and the availability and use of the ever dwindling scarce resources in many countries is the driving force pushing many countries to create or enhance their existing health information systems. There is tremendous pressure today on managers of health care organizations to address different challenges relating to rising costs of care, inefficiency, inconsistency of information for decision making, etc.

The availability of information through an integrated health information system can help countries increase efficiency, effectiveness and responsiveness at the national, regional, and local levels. Armed with the correct information, managers in all sectors of health care can align health system resources with patient or population needs and determine whether intended plans are progressing with increasing results or whether there is a need for corrective action. Moreover, the information produced by the system can ensure accountability within a health care organization in such a way that the patient in particular, the public, in general, and donors can determine whether they are obtaining value for their money, or not. Taking into account the continuum of care, the information generated about a patient or population's health can be studied and analyzed to better understand outcomes, providing valuable know-how that increases efficiency and effectiveness.

As the focus of the health care industry turns towards disease management as an effective option to improving the health status of the individual and population, there is a need to accurately record detailed notes and populate a comprehensive lifetime digital record for every patient in order to help doctors make clinical decisions and prevent medical errors, and health system managers make proper management decisions to improve health services, etc.

The overarching objective of the documentation that was developed during the author's internship with Populus Global Solution Inc. is to encourage the strengthening of national disease program management through the use of ACSiS (ACSiS Capacity Strengthening Information System) as a including its use as a powerful tool for monitoring and evaluation. The documentation serves to improve the quality of work done in disease program management by providing the framework within which the information needed for decision making at all levels of the health care system can be easily obtained and better utilized for health outcomes.

Organization Profile

Populus Global Solutions Incorporated (PGS) is located in Fredericton, New Brunswick. The company was founded in 1980 but its roots date back to 1967 when John Rutter who was the founding father worked on a United Nations project in Guyana. That project established the international consulting practice of John Rutter and Associates.

The company specializes in Health Information Systems development. Its ACSiS proprietary Health Information System has been recognized by the World Health Organization's Health Metrics Network as a best practice solution for developing countries. This comprehensive system enables effective centralized management of national, regional, or local health sector.

Recognizing that sound information is critical in framing evidence-based health policy and making decisions, and fundamental for monitoring progress towards national, provincial, district, and local health related development goals, PGS is committed to the development and operationalization of a functional health information system through innovative methods. It is guided by the following principles:

Principle for Building Strategic Partnership

PGS seeks to work with its partners in developing a viable solution to health information system through shared risks, shared resources, shared rewards, shared vision, and shared values.

Principle for Capacity Enhancement

To strengthen institutional capacity with a view to strengthening organizational problem solving and capability, PGS seeks to:

- Enhance and strengthen the capacity of health workers to collect accurate and relevant information
- Enhance and strengthen the capacity of health workers and managers at all levels to synthesize, analyze, disseminate, and utilize health information for evidence-based decision-making and for raising public awareness.

Principle of Efficiency

PGS harnesses the potential of technology to allow organizations and national governments to get the most from their intellectual and financial capital by training and supervising the most appropriate personnel in the development of health information system.

The author was to work within these principles and implicitly articulates them in the development of the documentation.

1. Introduction

Disease management as understood today represents a comprehensive, ongoing, and coordinated approach to achieving desired outcomes for a population of patients.(Huffman & Huffman, 2005) These outcomes include improving patients' clinical condition, reducing unnecessary health care costs and improving patients' quality of life. It signifies another approach to the delivery of care that is potentially viable for coordinating resources across the entire health care delivery system and throughout the life cycle of a disease. In fact, today health care systems around the world are preoccupied with continuity of care, avoidance of errors, patient safety, effective delivery of services, and avoiding excessive variation in practice such that disease management appears to be a reliable option to the delivery and the improvement of the quality of care.(Donaldson, 2004)

Health care managers consider disease management programs as a means of preventing major disease events and in so doing reduce the costs associated with hospitalization and other medical services for these events.

The need to manage the “diseases of affluence” such as diabetes asthma, cardiovascular disease, etc., is as urgent as the need to manage infectious diseases. Infectious diseases and re-emerging infectious diseases impose the greatest health burden on the world. It is estimated that on the global scale deaths of many millions of people are attributable to the following diseases: 1 million from malaria, 4.3 million from acute respiratory infections, 2.9 million from enteric infections and 5 million from AIDS and tuberculosis.(Mabey, Peeling, Ustianowski, & Perkins, 2004)

In developing the documentation for disease management using ACSiS the author sought to underline that, in the case of both, the so called “disease of affluence” and the third world infectious diseases, the use of ACSiS as a sophisticated health information system can be used to measure and monitor: clinical indicators, data relating to programmed algorithms, and clinical guidelines.

2. Internship Work

At the beginning of the internship, the author met with his supervisors, Mr. Jeff Beirsto and Mr. Calvin Pert to be briefed on his role and responsibilities. As noted in his contract, the author was to draw upon his experience, education, and certifications to produce a documentation entitled: **The Practical Use of ACSiS to Strengthen National Disease Management Programs.**

After an assessment of the current features of ACSiS and industry best practices, the document will cover at least the following broad aspects:

- Inputs and collection
- Analysis
- Monitoring and evaluation
- Outputs
- Impacts

The documentation will serve the purpose and quality criteria described below:

- To serve as a practical guide for ministries of health to design, implement and support sustainable disease management programs based upon the ACSiS health information system methodology.

In addition, during the completion of the document, the author was expected to play a consultative and leadership role under minimal coaching and supervision on the following activities:

- Within 5 days of start, under the direction of the Director of Delivery, develop a detailed task plan (with target dates for 1st and 2nd draft), Table of Contents (TOC) and become acquainted with the applicable current functionality of ACSiS
- Attend twice-daily checkpoints for progress, status and to raise issues, concerns or risks
- Report any noteworthy gaps between best-practices and current ACSiS functionality
- Submit timesheets daily as prescribed by the Director of Delivery

2.1 Getting to Know ACSiS Functionality

To better leverage the functionality of ACSiS and develop the required documentation for disease program management, the author had to acquaint himself with the software. An initial orientation was given to the author by his supervisor. However, the author had to familiarize himself with the software by spending time on each module of the software in order to grasp its functionality.

The key components of ACSiS are compared to the spokes of a wheel (see figure 1). Each spoke represents a specific component of the information generated. The spokes are held together by the Electronic Health Record (EHR) core which represents the backbone of all the information generated within the system upon which this framework is based.

The spokes are:

- EHR: Electronic Health Record keeps a longitudinal electronic record of patient health information generated by one or more encounters in any care delivery setting. It contains the personal data for each patient and records the basic details of each of their encounters with the health sector. An encounter is defined as a patient visit to outpatient, accident and emergency or inpatient wards.

The personal data collected contains: contact, next of kin and medical conditions. The encounter data collected contains: date, location, treatment type, diagnoses, procedures, services, supplies, clinical notes and transfer details.

- ADT: Admission Discharge Transfer spoke refers to the part of the system that tracks a patient from his/her arrival to the health facility to his/her departure. It is closely linked with EHR.

- COE: Clinician Order Entry spoke permits clinical providers to electronically create, dispense, cancel and administer prescriptions.
- FIN: Financial costing and pricing spoke records costs and prices for medical supplies, procedures, services and administrative activities. The functions of FIN include the ability to view an advice for costing and billing based on the patient's encounter data and payment source.
- LAB: Medical Testing (Laboratory, radiology, etc) spoke generates an information link with orders for tests, associates the test requests and eventual results. The scope of the tests range from laboratory tests to radiology to vitals.
- MCH: Maternal Child Health spoke helps to manage family planning, pregnancies, record delivery details, growth, nutrition, development milestones and the immunizations received and due for a child. The MCH spoke also serves to identify pregnancies of high risk status. These identified pregnancies can then receive care at an appropriate source and more frequent and intense monitoring.
- SCM: Supply Chain Management spoke tracks and manages the inventory of pharmaceuticals and medical supplies at each facility and across the entire nation. The system is capable of tracking items by lot and store location. This makes it possible for administrators to reduce waste by tracking inventory in a First Expiry First Out (FEFO) manner.
- HIV: HIV-AIDS case management spoke records the data collected during pre/post testing counseling as well as HIV/AIDS clinic visits. The tool records WHO staging criteria to help track the patient's progress.
- PH: Public Health spoke records health activities that are not primarily focused on an individual patient. They may include facility inspections and vector control activities.
- HR: Human Resources spoke enables the human resources departments to administer jobs, staffing, leave and requests for leave.

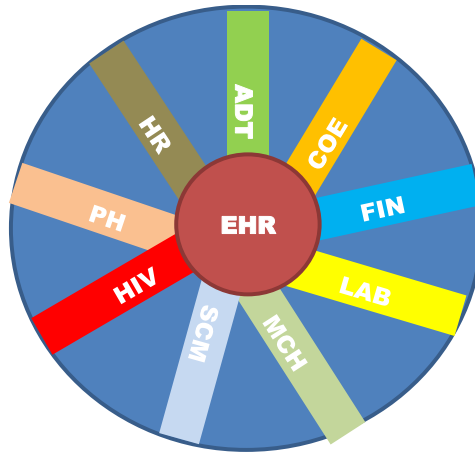


Figure 1: Wheel of ACSiS

The author spent a great deal of time simulating information flow through the system in order to understand and experience how the spokes of ACSiS turn. The author observed that as the spokes turn, the focus is centered on the interactions between the patient and the care-giver resulting in the collection of accurate information of the patient's status and hence, leading to the better management of his disease. Over time, an extensive disease management analysis can be conducted on the population's health because millions of patient records are stored and trends in care can be identified as well as common factors in patient care and outcomes. -Using ACSiS to identify this information makes it a system with the potential to give caregivers and care providers better insight into the manifestations of diseases, a deeper understanding of the costs for diagnosing those diseases, and an enhanced knowledge of how to manage those diseases more effectively and efficiently. The information obtained through the system also has the potential to improve payer's ability to manage costs and contracts to achieve optimal costs.

2.2 Developing the Documentation

To successfully develop the documentation the author had to take into consideration the following:

- The purpose of the document
- The audience
- Discover the linkages between ACSiS and disease management

2.2.1 Purpose and Audience

The employer had already defined the purpose and audience of the document. The author further reasoned that those concerned by the documentation to be developed must include health information system managers, monitoring and evaluation (M&E) managers and policy makers at all levels of the health system involved in decision making. Furthermore, the documentation should be usable by both organizations and countries with either well-developed or nascent health information systems, given that it is intended to provide advice for leveraging data captured by ACSiS to improve health outcomes

2.2.2 Linking ACSiS and Disease Management Programs

During his research the author concluded that a full-service disease management program must have all of the following six disease management components:(Fireman, Bartlett, & Selby, 2004)

1. *Population identification processes*
2. *Evidence-base practice guidelines*
3. *Collaborative practice models that include physicians and support services providers*
4. *Patient self-management education (may include primary prevention, behavior modification programs, and compliance / surveillance)*
5. *Process and outcomes measurement, evaluation, and management*

How does ACSiS strengthen disease management in taking into consideration those components? The author was able to highlight the following linkages during the development of the documentation:

- **Generate Customize Multi-purpose registries:** ACSiS records the observations made and outcomes of any class of health encounter for all patients within the sector. As such it is capable of producing 'registry-like' reports without the need for a disease specific registry. ACSiS generates registries based on multiple conditions. When criteria are selected, the system customizes the registry wanted based on the clinical information in the database.
- **Detail Access to Patient Information:** ACSiS inherent design allows the use of encounter form for each patient's visit that reminds the health care provider about services that are due. With options provided for free text, it documents clinical problems and medications

taken by the patients and records actions taken. Moreover, it captures vitals and unresolved diagnosis, patient lifestyle characteristics (such as Recreational Drug Use), symptoms and allergies.

- **Tracks Outstanding Orders and Referrals:** ACSiS generates call lists that identify patients who are overdue for services or patients with ordered but uncompleted tests. Such a list is used to contact patients, and or referred-to providers and help ensure compliance.
- **E-prescribing:** ACSiS allows healthcare providers to prescribe medications and allow for a two-way communication between the registry and the e-prescribing tool, allowing a provider, from one place to manage both care needs and prescribing needs. The system also allows the provider to send any number of predefined or adhoc instructions to the pharmacist, as well as the pharmacist providing predefined or adhoc messages to the care giver.

When diagnosing a disease, the author realized that ACSiS allows the following parameters to be included in the patient's record:

- Diagnosis
- Temporality
- Diagnosing Clinician
- On-set time
- Time of diagnosis

Temporality describes the sensitivity to time of the diagnosis. The options are:

- Acute (eg: fracture of clavicle, acute appendicitis, myocardial infarction)
- Subacute (eg: thyroiditis, osteomyelitis, hepatic failure)
- Chronic (eg: hepatitis, bronchitis, diabetes mellitus, instability of knee)
- Resolved (eg: used when the disease, injury, or condition is resolved)

Based on the above information, the author observed that ACSiS uses the following data sources to identify patients who may be targets of a disease management program. The data sources are:

- Encounter data
- Laboratory results
- Prescription data

Using these data sources, the author suggested that the following steps below can be used to set-up and maintain a recall and reminder system for a chronic disease:

Record Clinical Data

STEP 1

Data Method

In order to maintain an accurate record of a patient's active clinical conditions, a diagnosis must be recorded in the **Patient** view (clinical), **Encounter history** view or **Diagnosis history**

Identify Eligible Patients

STEP 2

Database Search Method 1

When patient diagnosis has been entered into ACSiS correctly, a search of the database can be run to identify all eligible chronic disease patients.

Note: Running this search will list all the patients who have been identified in their **Medical Info** as having the chronic disease

Another way to identify Chronic Disease Patients is by using the below method:

Database Search Method 2

This search is done based on the fact that certain types of drugs are prescribed to chronic disease patients. A search on any prescribed drug can be run to determine patient eligibility.

Set up Recall Database

STEP 3

Based on eligibility of all patients identified in step 2, recalls can now be set-up for all those patients listed who do not have a recall setup already for the chronic disease.

The chronic disease recalls is setup with specific intervals (weeks, months, or years), recall date, and frequency of recalls.

Search Recall Database

STEP 4

This step identifies all chronic disease patients due for recalls. The system alerts clinicians to outstanding actions and generate reminders that a chronic disease review is due when the patient's file is opened.

Generate Reminder Letters

STEP 5

The list of patients who are identified from the search recall database step 4 can be merged and printed with a document template adapted to any specified chronic disease. The reminder letter is subsequently mailed out to patients on the recall list.

Maintain Recall Database

STEP 6

During consultation with a clinician, the clinician can manage and update an individual patient recall while in the patient clinical record.

The above description illustrates how ACSiS can effectively be used in disease management programs designed to encourage prevention and regular monitoring of patients with chronic disease. Well thought-out disease management programs utilizing ACSiS as the system for effective monitoring of patient care can greatly improve health and consequently lower health care resources use such as inpatient and outpatient care, prescription drugs, and other services.

2.2.2.1 Disease Program Monitoring & Evaluation

The author also researched on how ACSiS can be used for routine monitoring of health status, provision of services, the mobilization and management of important resources such as pharmaceutical stocks and equipment, financing, and personnel. ACSiS was designed to support most health system strengthening for disease specific programs in operation in countries around the world. Effective disease program monitoring is necessary for both health organizations and governments in general to measure progress and assess whether resources result in more, and better, services as well as improved health outcomes.

The framework for health system strengthening comprises of four major indicator domains:(Aqil, Lippeveld, & Hozumi, 2009)

1. System inputs and processes: Structural aspects of a given intervention, such as financial inputs on monthly expenditures on personnel, drugs, drugs ordered vs quantity received, etc. (Actual activities such as how a disease management programme is delivered or implemented (how it worked) and the extent to which a programme was implemented as intended according to the evidence base. This might include stock outs of drugs, turnover rate by all personnel, loss of follow up index in health facilities, etc
2. Outputs: They are defined as productivity or throughputs – the immediate result of professional or institutional healthcare activities such as number of trained staff, number of stocks and delivery systems for drugs and other essential commodities, number of new or improved services, etc.
3. Outcomes: Outcomes are the medium and long term effects of healthcare or a health intervention on the health status of individuals and populations. They can be further divided across a continuum of categories from immediate, intermediate, post-intermediate to definite or long-term outcomes of health status. Increase in the use of a specific disease service or adherence to a specific drug, etc.
4. Impact: Indicators showing improved health status such as reduction in morbidity and mortality.

Whereas there are many diseases management indicators used in developed and developing countries, the author sought to underscore some Preventive Quality Indicators (PQIs) that ACSiS calculates. PQIs are a set of measures that can be used with hospital inpatient discharge data to identify "ambulatory care sensitive conditions" (ACSCs).(Indicators, 2001) ACSCs are conditions for which good outpatient care can potentially prevent the need for hospitalization, or for which early intervention can prevent complications or more severe disease.(Ansari, Barbetti, Carson, Auckland, & Cicuttini, 2003) Even though these indicators are based on hospital inpatient data, they provide insight into the quality of the health care system outside the hospital setting.(Indicators, 2001) They are commonly used in developed countries. The author explored the some of the indicators within the framework of the indicator domains of disease management program that can be calculated using ACSiS. On the other hand, in developing countries, tropical

diseases have such an enormous impact on the population that there is a link between these diseases and poverty and hence the prevalence of these diseases can serve as a proxy indicator of the level of a country's socioeconomic development.(WHO, 2007) Some of these indicators are also included in the table in the appendix B

3. Delivery of the Documentation

After completing the writing of the first draft of the documentation, a presentation was schedule on April 14, 2011 to acquaint the staff of PGS Inc. of the author's work. Mr. Nick Rutter, President, Mr. Jeff Beirsto, and Mr. Calvin Pert audited the presentation. Following the presentation, they expressed their pleasure about the utility of the draft documentation and said that the documentation will be used by PGS in their projects around the world. As of the writing of this report, the author is waiting upon the final inputs from Mr. Tristan Rutter, CEO of PGS, and Ms. Beth Webster, Vice President of PGS, and Colin Kilburn, Director of Development of PGS, to finalize the documentation.

4. Health Informatics and the Use of ACSiS for Disease Management

The author made extensive use of the knowledge of the course in "Health Information: Flow and Use" that he took during his training in health informatics. During the course, the author learned how to track the flow and use of health information in relation to the health of an individual or a population in general. The author also learned about how information is generated, collected, stored and used within health care delivery settings. In addition to what the author learned during this course, the author exploited his knowledge of the measurement of health and health services processes to study how ACSiS calculates various health indicators. Moreover, the author's knowledge of the contents of the course "Health Information System & Issues" was also invaluable in helping him to understand the role and impact of ACSiS as it collects synthesize and disseminate health related information on diseases management on the national level.

5. Challenge

The key challenge that the author faced was in finding the linkages and describing how ACSiS can be used to support community health workers in assisting disease management programs. It is easy to assume that ACSiS was built to be used in clinical settings but it could also be exploited to improve the consumption of health information at the community level and hence improve health outcomes. The author, coming from a low resource and heavily disease burdened country, knows very well that nowhere else is community based health information readily useful than in low resource and high burden environments. Having access to real time accurate and reliable information on the health of communities is essential in order to be able to provide appropriate services. The collection and dissemination of this information is important at the health facility level but also at the community level, given that the majority of deaths and illnesses never reach the health facility and so frequently go unreported.

The author adapted the following scenario (figure 2) based on the UNICEF methodology of using mobile technology for case management.(Frog, 2009) Community Health Workers (CHWs) using hand held

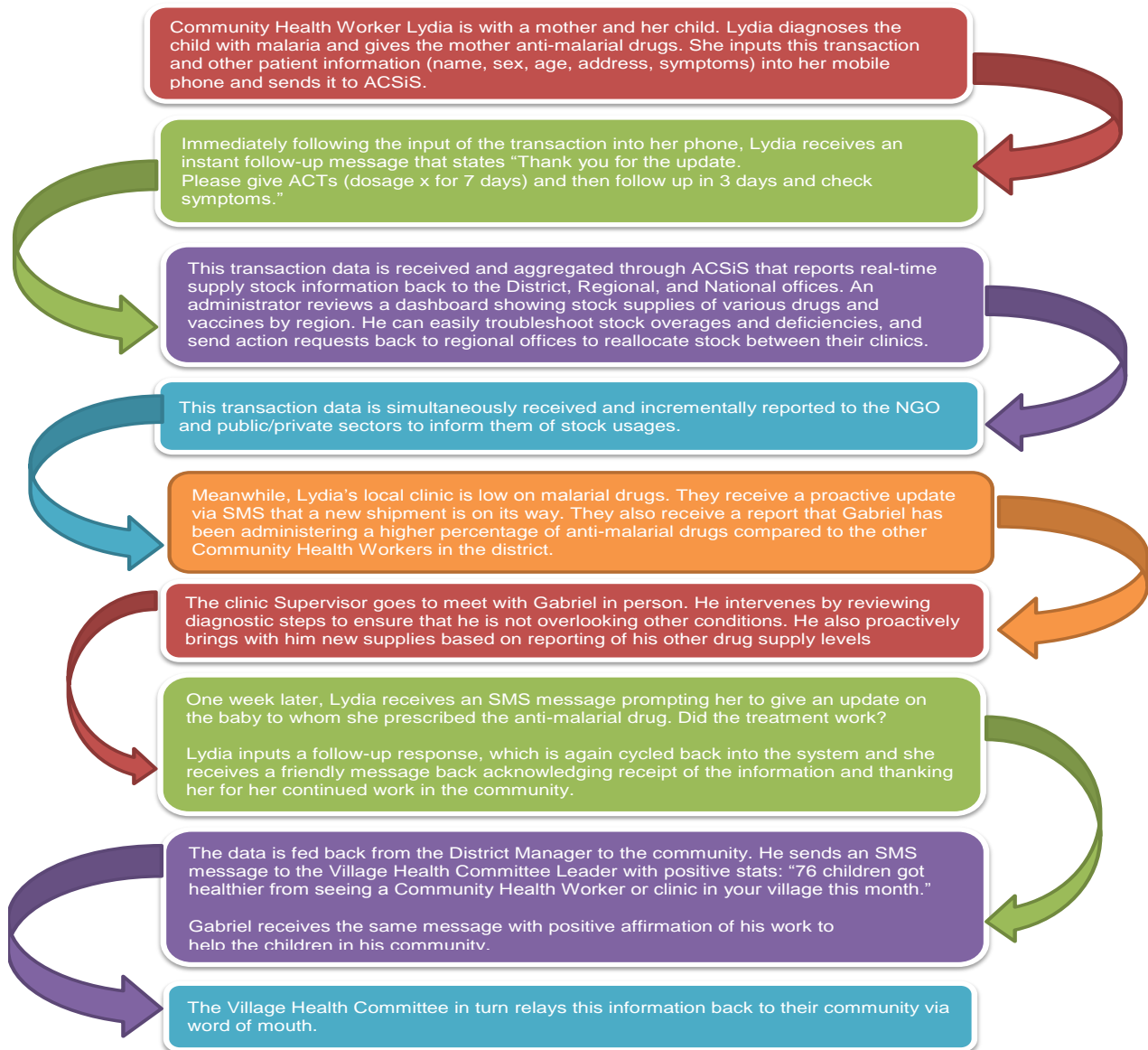


Figure 2: Community health worker and disease case management using mobile Technology

devices are privileged to a continuous stream of readily available information through ACSiS which they can use to foster case management through effective diagnosis, treatment, referrals, and follow-up. This enhances the quality of care.

What is evident is that CHWs can help reduce system costs for disease management programs by linking patients to community resources and helping patients avoid unnecessary hospitalizations and other forms of more expensive care as they help improve outcomes for community members.

The scenario indicates that near real time health data associated with disease management are so sensitive and the stakes are so high that to rely on the “old way” of data collection, analysis and dissemination is counterproductive and possibly ineffective for disease management. ACSiS uses a data replication scheme that is NOT reliant on persistent internet connectivity. This is an important differentiator of ACSiS's capability of working in a low resource environment. This near real-time capability of ACSiS solution can help national and regional health information systems that desire detailed, evidence-based data driven information to enhance their decision-making capabilities at the point of or across the entire continuum of care.

6. Conclusion

The author’s research as evident in the documentation concludes that ACSiS can strengthen national disease management programs by helping those programs to focus on the screening, prevention, and disease management needs of the patient. It can clearly identify the population of patients with a specific disease management needs and help programs to monitor them both on local and national levels.

The author also appreciated addressing the challenge of how mobile technology can be used with ACSiS in strengthening national disease management programs at the point of care. The efficiency of community health workers to diagnose and treat diseases such as malaria or tuberculosis would be enhanced in the author’s country and many developing countries with infectious disease burden if this solution is adopted.

7. Recommendation

ACSiS is a sophisticated health information system but does not include a traditional, integrated clinical decision support system. In order for it to fully support and strengthen national disease management programs, the author would like to recommend that the following improvements be made to the system to support:

- Computerized clinical practice guidelines: In most countries, developed or developing, clinicians sometimes fail to follow paper-based national clinical practice guidelines in the

management of diseases due to negligence or simply the lack of time to refer to these documents, resulting in variation in clinical practice that is not based on scientific evidence. Computerizing clinical practice guidelines within ACSiS will aid clinicians, especially in developing countries, to greatly improve the quality of care of those with infectious diseases and promote the use of interventions supported by the best evidence available.

- Patient education: Given that patients today are more concerned with the managing of their illness and are desirous of obtaining educational materials that help them to understand and adhere to treatment plans, there is a need for PGS to improve the capability of ACSiS to tailor information endorsed by clinicians as credible and applicable to the situation of each patient.
- Presentation: To enable the patient to visualize the trend and impact of the disease on him/her and thus comprehend his/her status, a data visualization tool should be incorporated into ACSiS in such a way that clinical data are displayed in graphs and charts. This could detail his/her performance against compliance measures as indicated in clinical practice guidelines.

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APPENDIX A: Snapshot of ACSiS

MAIN MENU ↓ SYSTEM MANAGEMENT ↓ NETWORK ↓ EXPORT ↓ LOGOUT

Patient Id 1005: Daniel Worpo, Male - Age 67 [View](#)

OUTPATIENT ENCOUNTER INFORMATION

– OUTPATIENT ENCOUNTER DETAILS

Encounter Start :

Payment Source

Payment Source's Co-Payment (%)

Product Type

Reason For Visit

Attending Doctor

Referring Clinician

Referred To Facility

Clinic

– ADDITIONAL NHI INFORMATION

Encounter Form Number

Received Referral Number

Appointment Time :

APPENDIX B: Key Indicators Calculated by ACSiS

Full Name of Indicator	Program component	Result Hierarchy	Numerator data name	Denominator data name
Diabetes Short-term Complication Admission Rate	Diabetes		Number of admissions for diabetes short-term complications	100,000 population Adjusted by age or sex
Diabetes Long-term Complication Admission Rate	Diabetes		Number of admissions for long-term diabetes	100,000 population Adjusted by age or sex
Chronic Obstructive Pulmonary Disease Admission Rate	Obstructive Pulmonary Disease		Chronic Obstructive Pulmonary Disease Admission Rate	100,000 population Adjusted by age or sex
Hypertension Admission Rate	Hypertension		Number of admissions for hypertension	100,000 population Adjusted by age or sex
Congestive Heart Failure Admission Rate	Congestive Heart Failure		Number of admissions for CHF	100,000 population Adjusted by age or sex
Low Birth Weight Rate	Child Health		Number of low birth weight births as a share of all births in an area	
Dehydration Admission Rate			Number of admissions for dehydration	100,000 population Adjusted by age or sex
Bacterial Pneumonia Admission Rate	Pneumonia		Number of admissions for bacterial pneumonia	100,000 population Adjusted by age or sex
Urinary Tract Infection Admission Rate			Number of admissions for urinary infection	100,000 population Adjusted by age or sex
Angina without Procedure Admission Rate	Angina		Number of admissions for angina without procedure	100,000 population Adjusted by age or sex
Uncontrolled Diabetes Admission Rate (Uncontrolled diabetes is	Diabetes		Number of admissions for	100,000 population Adjusted by age or

designed to be combined with diabetes short-term complications)			uncontrolled diabetes	sex
Adult Asthma Admission Rate	Asthma		Number of admissions for asthma in adults	100,000 population Adjusted by age or sex
Rate of Lower-extremity Amputation Among Patients with Diabetes	Diabetes		Number of admissions for lower-extremity amputation among patients with diabetes	100,000 population Adjusted by age or sex
Percentage of children 6-59 months with severe acute malnutrition who are treated and cured (disaggregated by sex)	Child Health	Outcome	Child 6-59 months with severe acute malnutrition who are treated and cured	Child discharged from SAM management programs
Cure rate among smear positive TB cases (Under Directly Observed Treatment Short Course)	Tuberculosis	Outcome	New sputum positive cases who are proved smear negative at the end of treatment	New sputum positive TB patients in the same cohort
HIV Prevalence of TB patient	Tuberculosis	Outcome	HIV positive TB case	TB cases
TB death rate	Tuberculosis	Impact	Death due to TB	TB cases
TB Mortality Rate	Tuberculosis	Impact	New smear-positive pulmonary TB cases died during treatment, irrespective of cause	Total new smear-positive TB cases registered in the same period
Treatment success rate	Tuberculosis	Outcome	New smear-positive pulmonary TB cases registered that were cured plus those who completed treatment	New smear-positive pulmonary TB cases registered in the same period
Case detection rate	Tuberculosis	Outcome	New smear-positive TB cases detected	The annual number of new smear-positive TB cases detected
HIV Sero-prevalence rate among TB patients	Tuberculosis	Impact	New registered TB patients (registered over a given period of time) who are HIV positive	New registered TB patients (registered over the same given time period) who were tested for HIV

Case Notification Rate	Tuberculosis	Outcome	New TB cases reported in the past year	Total population
New pulmonary TB cases with no smear result rate	Tuberculosis	Outcome	New pulmonary TB cases registered that do not have results of sputum smear examinations on diagnosis	New pulmonary TB cases registered during the same period
New adult smear positive rate	Tuberculosis	Outcome	New smear-positive adult (age 15 and older) TB cases registered	New adult pulmonary TB cases registered
Retreatment TB rate	Tuberculosis	Outcome	Retreatment TB cases registered	TB cases registered
New extra pulmonary TB rate	Tuberculosis	Outcome	New extra pulmonary TB cases registered	New TB cases registered
New TB cases with no smear conversion rate	Tuberculosis	Outcome	New smear-positive pulmonary TB cases registered were not examined at the end of the initial phase of treatment	New smear-positive pulmonary TB cases registered
Sputum conversion rate	Tuberculosis	Outcome	New smear-positive pulmonary TB cases registered were smear negative at the end of the initial phase of treatment	New smear-positive pulmonary TB cases registered
Cure Rate	Tuberculosis	Outcome	New smear-positive pulmonary TB cases registered that were cured	New smear-positive pulmonary TB cases registered
Treatment completion rate	Tuberculosis	Outcome	New smear-positive pulmonary TB cases registered that completed treatment and did not meet the criteria for cure or failure	New smear-positive pulmonary TB cases registered
Death Rate	Tuberculosis	Impact	New smear-positive pulmonary TB	New smear-positive pulmonary TB cases

			cases registered that died during treatment, irrespective of cause	registered
Treatment Failure Rate	Tuberculosis	Outcome	New smear-positive pulmonary TB cases registered that are smear positive 5 months or later after initiating treatment	New smear-positive pulmonary TB cases registered
Default Rate	Tuberculosis	Outcome	New smear-positive pulmonary TB cases registered that interrupted treatment for more than 2 consecutive months	New smear-positive pulmonary TB cases registered
Transfer Out Rate	Tuberculosis	Outcome	New smear-positive pulmonary TB cases registered that were transferred to another basic management unit for which there is no treatment outcome information	New smear-positive pulmonary TB cases registered
Prevalence of Multi Drug Resistant (MDR) among new and retreatment	Tuberculosis	Outcome	Case resistant to isoniazid and rifampicin	Estimated population
HIV Prevalence among 15-24 year pregnant women	HIV/AIDS	Impact	HIV positive test among pregnant women among 15-24 age group	Pregnant woman in 15-24 age group surveyed
Percentage of HIV infected pregnant women receiving a complete course of ARV prophylaxis to reduce the risk of MTCT	HIV/AIDS	Output	HIV infected pregnant woman receive a complete course of ARV prophylaxis	HIV infected pregnant women
People with advanced HIV infection receiving antiretroviral (ARV) combination therapy	HIV/AIDS	Output	Cumulative count of people with advanced HIV infection receiving antiretroviral (ARV)	

			combination therapy	
STI cases treated as percentage of population 15 years and older	HIV/AIDS	Output	Cases treated for STI	Population 15 years and older
Percentage of pregnant women (attending ANC) receiving two or more Intermittent preventive treatment (IPT)	Malaria	Output	Pregnant woman receiving 2 or more doses Intermittent preventive treatment (IPT)	ANC visit first
percentage of pregnant women attending ANC who received an ITN	Malaria	Output	Pregnant women attending ANC who received an ITN	ANC visit all (1st visit?)
Percentage of five and above population treated for malaria (including clinical malaria)	Malaria	Output	Malaria treated 5 years and older	Population 5 years and older per expected episodes
Malaria death rate (health facility-based)	Malaria	Impact	Malaria deaths	Deaths all
Typhoid cases treated as percentage of total population	Disease Surveillance	Output	Case treated for typhoid	Estimated population
Meningitis cases treated as percentage of total population	Disease Surveillance	Output	Case treated for meningitis	Estimated population
Jaundice cases treated as percentage of total population	Disease Surveillance	Output	Case treated for jaundice	Estimated population
Acute rheumatic fever cases treated as percentage of total population	Disease Surveillance	Output	Case treated for acute rheumatic fever	Estimated population
Acute watery diarrhea cases treated as percentage of total population (all age)	Disease Surveillance	Output	Case treated for acute watery diarrhea	Estimated population
Acute bloody diarrhea cases treated as percentage of total population (all age)	Disease Surveillance	Output	Case treated for acute bloody diarrhea	Estimated population
Annual incidence of morbidity due to non-communicable disease	Disease Surveillance	Outcome	New case reported to health facility with non-communicable disease	Mid-year population
Percentage of outbreaks detected and responded to within 48 hours	Disease Surveillance	Output	Outbreak that were actually detected within 48 hours and responded to immediately	Number of outbreaks
Top five causes of OPD visits with disaggregation of sex and under five, over five	Disease Surveillance	Outcome	OPD attendants by cause (top five in rank)	Total OPD attendants
Top five causes of admission with disaggregation of sex and under five, over five	Disease Surveillance	Outcome	Admission by cause (top five in rank)	Total OPD attendants
Inpatient death rate by cause: gender and under five, over five disaggregated	Disease Surveillance	Impact	Death at discharge by cause	Total discharged

APPENDIX C: Accomplishment Letter



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April 12, 2012

Dr. Grace Paterson
Associate Professor and Acting Director
Medical Informatics
Dalhousie University
1459 Oxford St
Halifax, NS
B3H 4R2

Dear Dr. Paterson:

Please accept this letter as a record of Gabriel Thompson completion of his internship requirements at Populus Global Solutions Inc. It was a pleasure to work with Gabriel as he authored a document that will help us focus our product development and sales efforts. Gabriel authored an internal "white-paper" entitled *Practical Use of ACSiS to Strengthen National Disease Management Programs*.

Gabriel demonstrated an ability to apply both his previous experience and his recent Health Informatics learnings. His work will be a key influence directing how PGS will represent and communicate the successful ACSiS Disease Management principles and methodologies.

On behalf of the rest of the PGS management team I'd like to express our appreciation for this opportunity. Please contact me if you have any further questions.

Best Regards,

A handwritten signature in black ink that reads "Jeff Beairsto".

Jeff Beairsto
Director of Implementation
Populus Global Solutions

