GIS enabled Hospital Readmissions Dashboard: Going beyond EMR Patients "place" becomes clinically relevant
RESOURCE REQUEST/IMPROVEMENT PLAN

James Martinez

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operations caused it to increase.

1 HANDLING INSTRUCTIONS

The title of this document is GIS enabled Hospital Readmissions Dashboard: Going beyond EMR Patients "place" becomes clinically relevant Resource Request/Improvement Plan.

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Points of Contact

	Local Level Contact	
1		
2	Name:	Dora Barilla, Dr.PH.
3	Title:	Principal Investigator
4	Center for Strategy and Innovation	
5	Agency:	Loma Linda University
6	Street Address:	11175 Mountain View Ave, Suite M
7	City, State ZIP:	Loma Linda, CA, 92354
8	Office:	909-558-3261
9	email:	dbarilla@llu.edu
10		
11	Name:	Matt Keeling, B.S.
12	Title:	GIS Solutions/ Data Analyst
13	Claremont Graduate University	
14	Agency:	School of Information Systems and Technology
15	Street Address:	130 East Ninth Street
16	City, State ZIP:	Claremont, CA 91711-6190
17	Office:	909-588-7941
18	email:	john.keeling@cgu.edu
19		
20	Name:	James Martinez, Ed.D.
21	Title:	GIS Solutions / Data Analyst
22	Claremont Graduate University	
23	Agency:	School of Information Systems and Technology
24	Street Address:	130 East Ninth Street
25	City, State ZIP:	Claremont, CA 91711-6190
26	Office:	909-588-3630
27	email:	james.martinez@cgu.edu

2 EXECUTIVE SUMMARY

The improvement plan for a Geographic Information System (GIS) enabled hospital readmissions dashboard will assist hospital administrators, nurses and executives and hospital quality improvement efforts, and coordinating care for complex patients with conditions that represent 20% of all readmissions. The hospital readmissions reduction program was established as part of the Affordable Care Act section 3025 and Social Security Act 1886(q) (cms.gov). CMS is penalizing hospitals with high rates of patient readmissions within 30 days of discharge for the following medical conditions: acute myocardial infarction, heart failure and pneumonia and recently added chronic lung problems and elective hip and knee surgery to the list. (cms.gov). This created a response of urgency by hospital administrators to create dynamic data platforms and medical response directions to help improve quality indicators and performance metrics for hospitals level of productivity and evidence-based approaches to comply with readmission policies and avoidable reimbursement penalties.

The significance of the hospital readmissions improvement plan is aligned with the operational values of the agency and supports the overall mission and compliance mandates. The GIS enabled platform also gathers performance-based measures to support hospitals and complex reporting demands and time sensitive decision making processes necessary to intervene with complex patients. The absence of more complex GIS capabilities limits hospitals and in particular administrators, nurses and executives from making more informed decisions.

Additionally, the lack of more powerful data analysis platforms to hospitals identify, monitor and measure quality processes over time and translation into meaningful information that will collectively and collaboratively help improve quality indicators and performance metrics warrants the need for a GIS resource and improvement plan. Moreover, the inability to perform analysis on complex data would limit the type of performance-based measures hospitals could realistically provide communities without considering patients "place" as a clinically relevant indicator.

The improvement plan focuses on four target capabilities that will help guide the development of a fully integrated, cost effective, person centered hospital readmissions reduction dashboard that helps ensures that all patient needs are met before they are released or return to the hospital for the same condition within 30-days of discharge as defined by the Centers for Medicare and Medicaid Services (CMS).

- Planning: Hospital Readmissions Reduction - Strategic Plan

- Evaluating the Hospital Readmissions Reduction - Business Needs

- Needs Assessment: Hospital Readmissions Reduction - Applications and Info Gathering

- Implementation Plan: Hospital Readmissions Reduction - Recognition of Indicators and Warning Capabilities

The platform development phase was composed of three members from LLU and ESRI, and feedback from 10 CGU students. The improvement plan team had various backgrounds and included hospital executives, planners, research strategists, data architects and GIS specialists.

The objectives in this improvement plan for a hospital readmissions dashboard are:

1. Objective 1: Design a hospital readmission dashboard that can integrate with other assessment platforms to enhance the identification of high-risk patients for avoidable 30-90 day readmissions after discharge (GIS needs analysis)

2. Objective 2: Allocation of resources to fulfill resource request, including routing for nurses or care teams to follow-up on complex patients within 48 hours after discharge, home visits for collecting vitals, symptoms and medication education and prescription refills if needed (components)

3. Objective 3: Evaluate robustness of improvement plan and response for each condition category groups MI, HF, PN, COPD and THA/TKA (requirements)

4. Objective 4: Planned Implementation of the GIS resource and improvement plan

5. Objective 5: Value regarding the improvement plan (costs and benefits)

Centers for Medicare and Medicaid Services (CMS) is continually working on enhancing existing policy and performances on the readmission reduction plan through accountability, and, improving processes, quality of care, and the implementation of innovative new technology. The purpose of the resource request/ improvement plan using GIS technology for hospital readmissions is to analyze "place" as a limitation to health in some cases and identify strengths of existing systems to be maintained and built upon, identify potential areas for further improvement, and support development of corrective actions.

3 Test Environment

The major strengths of Loma Linda University Medical Center (LLUMC) as the test environment were identified are as follows: They were ranked No. 1 for best hospital in the Inland Empire, which operates the region's only level 1 trauma center and the only children's hospital (U.S. News World Report)[1]. With nearly, 900 beds, each year, more than 33,000 patients are admitted and roughly half a million are served through outpatients services and over 58,000 patients are evaluated by LLUMC emergency department. In addition, Loma Linda provides assistance in governance, accounting, and fund-raising for 32 other Adventist Health hospitals and 52 clinics in 13 countries. Loma Linda University also recognize the importance of "place matters" when it comes to one's health and creating GIS applications that are integrated with Electronic Health Records (EHRs) to help improve health and quality of life and policy and decision making[2]. Loma Linda University Medical Center continues to seek ways to improve patient care and outcomes and a GIS enabled platform will support LLUMC executive leadership and unprecedented capabilities to identify patients in real-time that are admitted and readmitted within 30 days and enhance

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[1]http://health.usnews.com/best-hospitals/area/riverside-san-bernardino-ca
[2]http://www.esri.com/news/arcnews/fall07articles/loma-linda.html

assessment capabilities and strategies to reduce 30-day readmission rates. This adoption makes LLUMC an ideal candidate to implement the hospital readmissions dashboard as a prototype and evaluate the robustness of the improvement plan for each objective area and condition category groups (i.e. MI, HF, PN, COPD and THA/TKA).

4   Primary Initiatives

The primary aim of developing the improvement plan and research is guided by Affordable Care Act policies and to help improve patient care by reducing 30-Day readmission rates and the urgency to reduce readmissions cost to Medicare of $15 billion each year. This initiative is also aligned with Loma Linda University Medical Center, integration of Electronic Health Records (EHRs) and hospital readmissions reduction efforts on the following conditions:

- Acute Myocardial Infarction (AMI)

- Heart Failure (HF)

- Pneumonia (PN)

- Chronic Obstructive Pulmonary Disease (COPD)

- Elective hip and knee replacements (THA/TKA)

The research question surrounding the development of a readmissions dashboard is not based on replacing current systems but rather the question of the integration of Electronic Health Records (EHRs) and "how can a readmissions dashboard help hospitals comply with ACA policies, improve patient care and avoid preventable reimbursement penalties?" This will involve a visualization plan and rigorous evaluation of capabilities, including real-time data feeds for all hospital admissions and readmissions for the six conditions (i.e. AMI, HF, PN, COPD, THA/TKA) and routing for transitional care nurses that follow-up with patients after they are discharged. Patients at-risk for hospital readmission also benefit from the implementation plan that is patient focused because nurses and case managers will have the ability to addresses concerns in regards to patient follow-up appointments and patient comprehension of discharge and medication instructions.

The implementation plan will have several development and evaluation phases to assess the intended purpose for the application and system integration factors. Phase one includes two main functionalities. The first is by establishing a real-time linkage for spatially enabled hospital admissions data feeds of selected ICD and DRG codes. This will enable the dashboard to identify risk patients with an index admission and readmissions to the hospital and project details about their condition, vitals and demographics. The second functionality of phase one is to include routing capabilities for nurses and case managers to follow-up on patients based on readmission risks and clinical need after discharge from the hospital.

In addition, to the improvement plan, phase 2 will enhance capabilities for a more robust platform to improve patient care at arrival and discharge from the hospital. This will also provide further capabilities for other questions regarding "what happens to patients prior to admission, during hospitalization and after discharge? " The platform will require further

development of a fully integrated JavaScript application with linkages to community overlays by census tract, service areas, political boundaries, zip code and other assets, such as support groups, pharmacies and other lifestyle resources. The final phase of development will include building on the lessons learned through usability analysis from selected test environments and recommended settings for integrating Electronic Health Records (EHRs), hospital index admission and readmission measures, including transitions after discharge from the hospital.

5 BUSINESS OVERVIEW

Costs of Readmissions

The AHRQ summary breakdown for 30-day readmissions by payer is as follows:

- Medicare (annually): $17 billion

- Private Insurances (n=600,000): $8.1 billion

- Hospitals (n=7000,000): $7.6 billion

- Uninsured (200,000): $1.5 billion

- Heart Failure: $1.35 million

- Pneumonia: $1.1 billion

- Hospitals affected 2013 (2,225/5,700): $227 million

- Loma Linda University MC .24%: $25 million
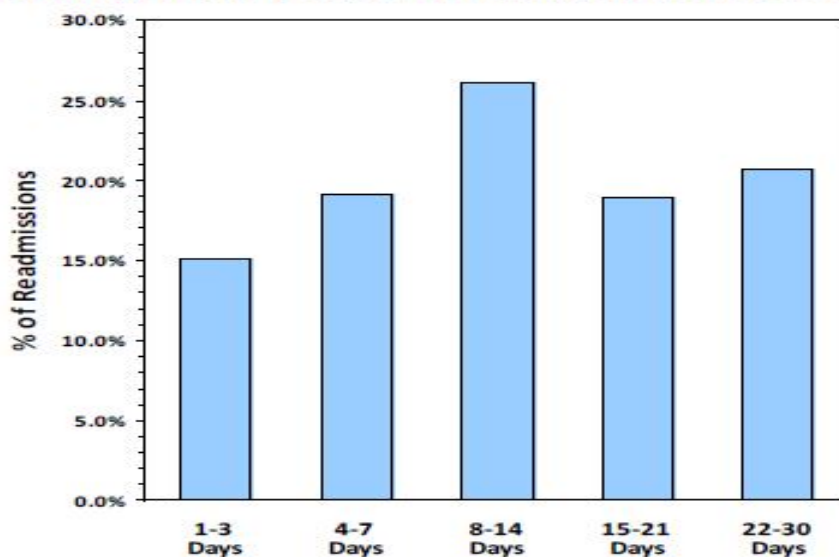   Primary Areas for Improvement please refer to Figure 1

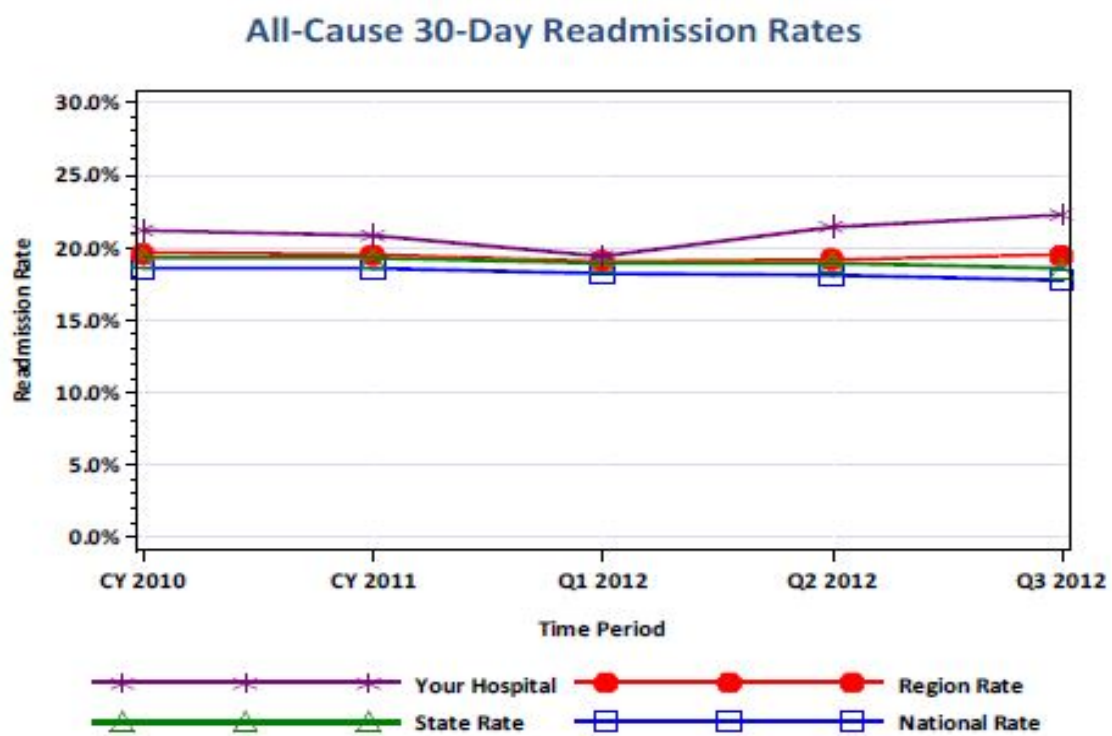Figure 1: Number of Days from Discharge to Readmission for All Discharge Setting

Figure 2: All-Cause 30-Day Readmission Rates

	Component Information Systems	Device or Service	Application	Cost	Users	GIS	Data	Score	Assumptions Notes Terms
1	Microsoft Windows 7	Operating system	Enterprise Base system. IT, DBA, Systems Admin	500			10	10	Information products required by department
2	Microsoft Word	Word processing	Need to know by Depart	100			9	9	Information products required by department
3	Microsoft Access, Excel	Database, Spreadsheet	Warehouse, Manage, merge analyze data and reports	150			8	8	Data handling, create and manage database, analysis of mandates and responsibilities
4	Internet	API Web Map	Email, Mesh map, web svs.				9	9	Information products required by department
5	GIS ED Dispatch/24-hour Call center	ArcView 10	Topographic map, Attribute info, for Emergency Response, IT, DBA, Systems Admin	2000		10	7	17	Historical data analysis, project best routes to take via location allocation and market share analysis and planning
6	Oracle/SQL	SDE	Enterprise file gdb, IT, DBA, Systems Admin			9	7	16	Greater application needs and required to run SDE ArcGIS software
7	Tablets	Case management services	File transfer, Field notes, IT, DBA, Systems Admin	1800		8	5	13	

Table 1: Software and System Implementation

6 Needs Assessment

Costs of Readmissions

7 Business Plan Overview

Loma Linda University Medical Center is a well-respected hospital and is the only level one regional trauma center for the Inland Empire. This also includes serving neighboring Inyo and Mono Counties. Unfortunately, compliance is an issue and preventable readmissions with better GIS capabilities and analysis will improve performances. In 2013, LLUH was penalized and was not reimbursed for claims totaling over $2 million dollars in liquidated damages. The first six months of the current year follows a similar trend from Jan to June, 2014. The current processes still do not include effective GIS planning and analysis. The current infrastructure is based only on their EHR system by Epic. The implementation plan for integrating a readmissions dashboard with a care management component that follows up on patients after discharge will be a major solution to avoiding preventable readmission penalties. The problem with their existing technology is that it might be out dated and perhaps, ineffective to support the population changes, and demands, particularly in the high desert region. Please referr to Table 2

7.1 Initial GIS Plan Funding

	DESCRIPTION	Year 2014
1	GIS Evaluation and Data Entry	4,035
2	GIS Integration with EHR systems	17,493
3	GIS Design, Development and Implementation	14,969
4	GIS Materials, Integration, Printing and Production	5,784
5	GIS Software, Licenses and Services	23,516
6	GIS Data Warehouse, Server Maintenance	4,210
7	Agency Fee (9.5%)	18,594
8	Miscellaneous expenses	9,426
9	TOTAL BUDGET	11,1148

Table 2: New Budget

7.2 The Porters Five Forces

The software industry is in constant state of flux or is easily stirred, given the continuous and relentless improvements in software languages, hardware, and/or network capabilities. When it comes to the five industry forces, the industry's threat of entry force offers a moderate unfavorable condition. The economies of scale are the most favorable dimension in this force. However, established

	Year	Rancho	Redlands	Victorville	Size of Market	Percent	Total Market
1	2012	19,278	30,682	80,914	130,875	58,894	47,115
2	2013	21,993	33,941	83,086	139,020	62,559	50,047
3	2014	21,179	35,570	86,345	143,093	64,392	51,514
4	2015	20,636	33,669	84,172	138,477	62,315	49,852

Table 3: Estimated market Size

companies have increased the entry into this industry. For the supplier power dimension, the industry has a moderately favorable condition given that the raw materials, namely class schedule and program data, may not be costly to obtain. In addition, qualified programmers may be difficult to locate, especially locally. In the realm of buyer power, the industry tilts this market force into the moderately favorable area given that there are no academic planner applications that offer the same benefits or have the same features. The application buyers are deemed to be sophisticated enough to demand more benefits from the application than originally planned. This is the case with the existing program they are using. In the area of threat of suppliers, the hospital industry has a moderately unfavorable condition. Private companies have the option to buy the GIS application or to develop their response plans by trial and error by doing them manually using their own CAD systems by Intergraph. The competitive rivalry assessment results are highly unfavorable, given the intangible product's attributes, and the relative visible pricing schemes that software applications have.

Although some of the of the Porter's five industry assessments are not favorable the overall assessment is moderately favorable because the industry offers increasing (or high) economies of scale once the GIS Business Plan is developed and launched. Nevertheless, the continuous changes in the several factors in the industry, software, hardware need to be managed effectively and creatively so that they do not become a liability or a risk.

In terms of the current target market is the changing communities in the county's population and density within San Bernardino. There are more than 2 million with a population density estimated at 103 persons per square mile of the 20,000 square miles of land; however, the once rural desert and suburban regions have developed and includes over 93% of the county's land area and parts of the Mojave Desert.