

# Chapter 19

## GIS Based Health Information Management through LETL, Multi Criteria Query, Analysis, Visualization

Sunitha Abburu

*Department of Science and Technology, New Delhi, India*

### ABSTRACT

*For effective decision making in public health information management(HIM) system, health information availability, accessibility, prompt exchange, GIS linkage, spatiotemporal analysis of diseases is crucial. Lack of cost-effective technical support and information gaps are the main obstacles in HIM. This article defines a generic conceptual process framework for effective HIM that provides cost-effective, portable, easy to use solution. The solution incorporates GIS, Mobile technology, information management concepts, ICD-10 codes, WHO and mHealth standards. The current research is implemented as an android application that facilitates: 1) Patient disease data collection, geospatial mapping of disease data and accumulate a centralized server 2) LETL that supports bulk disease data upload 3) Addresses syntactic and semantic heterogeneity in health data 4) A strong multi-criteria query engine, visualization and spatiotemporal analysis of diseases are designed with a global perspective to be used across the globe.*

### INTRODUCTION

Decision making plays a crucial role in public health domain (Wilbroad et al., 2013). The right information at the right time to the right people, impacts decision making in public healthcare system. The high-level administrative decisions regarding public health reforms, preparedness, actions, responses etc., need effective health data management, querying schemes, visualization and health data analytics system. Health data analytics supports better decision making, predictive analysis, strategic planning, cost-effective solutions, etc. Health Information Management (HIM) can derive the benefits from the treasure of health data by facilitating health analytics.

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Health policymakers require an effective healthcare information infrastructure that supports efficient and quality decision making. The policymakers need to do health data analysis to make decisions and plans like what medicines need to be distributed to the public health centres, Where and when additional health camps need to be conducted, Region based preventive measures, Geo reference based precautionary healthcare measures, Geolocation based health plans, geolocation based response and actions, deputation of appropriate specialist to the regions and disease alert based preparedness etc.

The R&D project “Development of Semantics Driven Geospatial Public Health Management System” funded by Department of Science and Technology (DST), Ministry of Science and Technology, Govt. of India has been initiated for an effective public healthcare system and to bring quality and actionable clinical and financial insights into the public healthcare system. As part of this research, a series of interactions with various health officials in the state of Tamil Nadu is been conducted to identify challenges that are faced by health officials at various administrative levels. The issues that are identified in the health sector are lack rapid cost-effective solution for patient-disease data accumulation from rural and urban places, GIS linkage of patient disease data, region-based information accessibility, availability to the information regarding remote villages and information exchange methodology. To resolve the issues, the main challenges are scattered patient-disease information and semantic and syntactic heterogeneity of vocabulary in health data.

Various health organizations are producing daily and monthly reports that give volumes of public health related data resulting in a multivariate dataset (Kuhu, Rekh, Ranjeet, Akash and Amir, 2017). Healthcare organizations are looking towards improving coordination, collaboration and communication among health officials, the outcome facilitates planning and evidence-based practice by generating important information from available data. The data in most of the health information management portals are available in either Excel or PDF formats, which limits information discovery and reuse (Binyam, Tomi, Carsten, and Fleur, 2014).

The current work focusses at providing a technology-based solution for effective decision making by health officials, public health policy and decision makers, through mobile Health (mHealth) application by adopting the World Health Organization (WHO) and mHealth international standards with a global perspective. The aim the paper is to provide a cost-effective solution to collect, accumulate patient disease data and provides a querying system for GIS based disease data analysis and decision making. The solution is a generic conceptual process framework for effective health information management system through extracting and accumulating data from multiple files.

A mHealth application has been designed and developed with a generic and conceptual process. A global mobile application has been developed as a product which is not specific to any geographic location and any specific disease. This is based on the practical problem originated at health centers at Tamil Nadu state, India. The application is designed and developed looking at the global prospective to be useful to other states and locations across the globe, in general.

The key objectives of the research are:

- Provides privacy and security to the health data by adopting WHO standards
- Provide a solution for patient data collection from rural and urban
- Provide bulk data upload facility to the health workers from multiple health centres
- Address syntactic and semantic heterogeneity of vocabulary using International Classification of Diseases version 10 (“ICD-10,” 2016)
- Geospatial mapping of disease data and cost-effective centralized remote database for storing

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