Abstract
Geotechnologies provide decision support for numerous public health issues such as determining locations of healthcare facilities for a given population. With limited population health data available for developing countries, geotechnologies provide little benefit in this regard. This report attempts to assist public health practitioners in overcoming the health information gaps common to developing countries for determining health related demand locations. We introduce methodologies that use generally available information from Demographic and Health Surveys (DHS). Burkina Faso, a developing country and a country with poor health quality, is used in this report as a case study to show how limited data, and data not generally considered for spatial analysis, can be used to locate multiple demand locations for healthcare. The clustering of health related locations and population densities along access routes and in proximity to villages ultimately determined the final demand healthcare facility locations.

Results
Demand based on population and including health risk factors varied throughout Burkina Faso in each province. The four health risk factors and wealth index used for this analysis proved to be influential in locating areas of demand for healthcare facilities. The highest rates of demand based only on health risk factors were found in three main clusters located in the northern central provinces, southeast provinces and in the southwest provinces. Overall, high economic and health values were found on the edges of the country while lower economic and health risk values were prevalent around Ouagadougou, the capital city of Burkina Faso located in the center of the country.

Using multiple factors besides population that were included in this analysis drastically changed the demand area in a geographical region. When high levels of health risk factor cases occur in a region where there is little difference in population density, the health factors had more influence in locating areas of demand. Including economic and health risk factors in the methodology provided a more serviceable way to allow the disadvantaged population to receive the maximum amount of access to healthcare facilities.

Background
Millions of people die in developing countries due to healthcare needs not being met. Developing countries have higher disease rates than first world countries and also have more severe resource constraints and limited access to healthcare (Hjortsberg & Mwikisa, 2002, World Bank, 2010). There have been multiple studies analyzing healthcare demand in populations that are considered in need (Schepes et al., 2011, Comber et al., 2011). Identifying access to health resources is crucial in caring for the disadvantaged populations in areas with high health demand (Yao & Murray, 2014).

Geotechnologies have proven to be beneficial for facility site selection. Such applications as location analysis, modeling central themes, locating areas of high demand, spatial weights, distances, and suitability analysis can be completed with geotechnologies (Murray, 2010; Curtin & Church, 2006). An empirical Bayesian kriging (EBK) spatial interpolation predicts the values of nearby cell locations that lack sampling data (Childs, 2004). Spatial interpolation for studies such as this provide an understanding of spatial health issues in developing countries where data may be sparse or have spatial data holes. Factors that were considered nonspatial, such as malaria rates, can be given a spatial dimension to help determine spatial patterns of health issues.

Conclusions
Geographic analysis is a widespread tool used for many decision support scenarios. Methods outlined in this report demonstrate the ability of practitioners to determine health related demand locations with limited information. Understanding the spatial accessibility is an important facet to consider when locating and allocating healthcare facilities. The information used in this analysis is commonly available data for public use from open-source GIS data outlets, providing a method and process for overcoming limited digital data. The ability for healthcare planners to weigh factors that were once thought to be nonspatial with the use of GIScience can be a helpful in serving the underserved population receive advantageous access to healthcare facilities were demand is the greatest.