Supporting Comparative Effectiveness Analysis for Fact Based Policy Development: an End-to-End Solution

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Abstract

Pressure is building to ensure that limited healthcare resources are allocated to provide effective care. Policy decisions need to be made in an evidenced-based manner, a task poorly supported by existing systems. We present our solution, an end-to-end comparative effectiveness analysis (CEA) prototype scoped by a use case on obesity. CEA contrasts two or more competing programs based on clinical outcome and cost. The insight it provides can be used at the population level to guide decision makers. Our system integrates clinical data from multiple sources in a privacy- preserving manner, handles missing data, and uses a data warehouse cube to abstract information critical to policy makers. Knowledge about the relative impact of competing healthcare programs is published in dynamic, online dashboards to facilitate collaboration. Feedback from domain experts demonstrates the utility and usability of our preliminary work.

Keywords:

Public health informatics, Comparative effectiveness, Business intelligence, Clinical analysis.

Methods

In this section we present our prototype CEA system. We demonstrate our approach with a hypothetical use case in which a healthcare policy analyst must determine the relative effectiveness of three different weight loss programs of differing intensities.

Patient data was generated using statistical distributions obtained from the US 2000 Census and a major health plan clinical database. Identifiable information was removed using k-anonymity to ensure HIPAA compliancy. Only data relevant to the evaluation of competing weight-loss strategies in our use case study such as age, gender, county, assigned weight-loss program, risk factors, weight at weigh-ins, etc was retained. To determine the relative effectiveness of the weight loss programs, we used average percent weight loss by patients over the period of a year as the key performance indicator (KPI).

The integrated and sanitized data was loaded into a Cognos data warehouse. The KPI was designated as the measure and an environmental variable and a genetic variable known to increase the risk of obesity as the dimensions. We also included a spatial dimension, county, to evaluate variation in KPI over geography.

Results

There are several key features of our system that can benefit CEA. It addresses the need to clean, integrate and sanitize data. Queries on the OLAP cube dynamically pull the underlying data through the filter of the cube allowing subsequent changes to be easily made. OLAP tools allow dynamic and interactive multidimensional analysis and support the ad hoc analysis typical of CEA. Fast retrieval of an organization's historical data as provided by a data warehouse supports the analysis of trends in the effectiveness of clinical programs over time. The web-based nature of our data warehouse supports better collaboration as all stakeholders can access the same data, analytical tools, and dashboards concurrently.

However, there are a number of outstanding issues. Being able to keep the input data in its native format or another format with richer modeling capabilities could unveil interesting new outcomes. Identifying information, such as geographic subdivisions smaller than a state, which HIPAA dictates must be removed could be useful in comparing programs. Finally, some usability issues surfaced with the data warehouse: there is no version control for reports or dashboards and cube design is not an intuitive or easy task.

Conclusion

Our work provides a preliminary end-to-end CEA system to support the evaluation of competing healthcare programs and therefore how best to allocate constrained healthcare resources. While our work is still in the exploratory phase, preliminary feedback from domain experts has demonstrated that it is something that would be very useful to policy makers in evaluating competing healthcare programs. We demonstrate that business intelligence tools can support collaborative CEA and help guarantee a sustainable future for healthcare.