

Chapter 35

Non-Traditional Data Mining Applications in Taiwan National Health Insurance (NHI) Databases: A Hybrid Mining (HM) Case for the Framing of NHI Decisions

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ABSTRACT

This study examines time-sensitive applications of data mining methods to facilitate claims review processing and provide policy information for insurance decision-making vis-à-vis the Taiwan National Health Insurance (NHI) databases. In order to obtain the best payment management, a hybrid mining (HM) approach, which has been grounded on the extant knowledge of data mining projects and health insurance domain knowledge, is proposed. Through the integration of data warehousing, online analytic processing, data mining techniques and traditional data analysis in the healthcare field, an easy-to-use decision support platform, which will assist in directing the health insurance decision-making process, is built. Drawing from lessons learned within a case study setting, results showed that not only is HM approach a reliable, powerful, and user-friendly platform for diversified payment decision support, but that it also has great relevance for the practice and acceptance of evidence-based medicine. Essentially, HM approach can provide a critical boost to health insurance decision support; hence, future researchers should develop and improve the approach combined with their own application systems.

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1. INTRODUCTION

Fueled by the massive amount of mandated data to be manipulated routinely and automatically, the resulting information deluge faced by healthcare insurance systems characterized by a single payer (monopolistic) and/or a few payers (oligopolistic) has, in turn, caused traditional information retrieval methods and data analysis to perform inadequately. As a result, the new interdisciplinary field of data sciences, encompassing both classical statistical methods and modern machine learning tools to support efficient and effective processing and mining of information as well as the discovery of knowledge (and hidden patterns) from enormous databases (Han, Kamber, & Pei, 2012; Gupta, 2014) is now gradually being realized and implemented.

Meanwhile, the growth of health expenditures is the most challenging risk to healthcare systems worldwide. In 2014, for example, the US government spent 1.1 trillion for Medicare and Medicaid. By 2030, expenditures for these two programs are projected to consume 50% of federal budget. Cost and spending factors drive needs for change. Given that healthcare organizations are typically characterized as complex adaptive systems with multi-stakeholders (Tan et al., 2005), they are also known to be highly information dependent; therefore, knowledge intensive technology is vital to the survival of these complex organizations and systems. Using health data analytics and data mining techniques to make business decisions for increasingly complex adaptive healthcare organizations and systems can effectively influence cost, revenues, and operational efficiency while maintaining a high level of care.

To date, various data mining (DM) methods and application systems approaches have been promoted. Unlike the traditional statistical and online analytical processing (OLAP) tools, these newer techniques have integrated algorithmic and inductive approaches to facilitate advanced data analysis and decision support to yield business intelligence (Rupink, Kukar, & Krisper, 2007). Some researchers have explored the use of DM in the development of a decision support system (DSS) to manage healthcare services (Sliver et al., 2001) while others have provided the outcome of mining methods in the value of quality improvement (Lee et al., 2011). Owing to rapid advances in data sciences (and big data processing technology) on the one hand and an increasingly complex, competitive environment on the other, newly mined knowledge is becoming pervasively critical to aid decision making in today's rapidly changing healthcare environments and systems.

Hybrid mining (HM) approach (Chen & Cheng, 2012) underlies a novel design for uncovering knowledge embedded in complex data systems linking multiple stakeholders as exemplified by the National Health Insurance (NHI) databases in Taiwan. In Taiwan, the national health expenditures in 2012 totaled 6.6% of GDP, although this compared favorably with 16.2% in the same year for the US. More surprisingly, apart from higher expenditures, life expectancy of those residing in the US is still lower than Taiwan by at least 2 years.

Structurally, the Taiwan NHI has been mandated and set up as a monopolistic social insurance plan, a mandatory healthcare plan characterized by a centralized disbursement of funds with its administration cost budgeted at only 1% of total expenditures. It is financed primarily through direct government funding, employment premiums and user co-payments. Patients just need to present their health insurance cards when visiting with a care provider. The National Health Insurance Administration (NHIA) will reimburse payments to the providers (Figure 1).

In 2002, in light of the need to avoid ongoing losses and for cost containment, NHI moved to alter the payment system from a fee-for-service to a global budget, foreshadowing a kind of prospective payment system (PPS). Meanwhile, Taiwan had plans to reform its payment schema to include case payment,

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