JMP and Visual Six Sigma: A Recipe for Optimal Healthcare Outcomes

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Introduction

JMP® statistical discovery software from SAS® is helping healthcare leaders solve the real problems of data management in healthcare quality improvement. This new initiative is meant to answer the call to improve the quality and efficiency of healthcare delivery at the level of clinical microsystems, healthcare’s equivalent to the smallest replicable unit [SRU], and is a direct response to the 1999 Institute of Medicine [IOM] report, To Err Is Human. There is a current trend towards population-based healthcare, which incorporates elements of clinical epidemiology into decision making at the point of care. JMP® can offer providers, managers, and quality improvement [QI] specialists state-of-the-art analytical tools for decision support at a reasonably low cost. Visual Six Sigma [VSS](1) is a flexible and comprehensive strategy to use JMP® in any setting, for a variety of QI applications. Dynamic visualization offers healthcare professionals an intuitive style of statistical analysis that is easily accessible to non-professional statisticians. The problem of readmissions from Chronic Heart Failure provides an excellent example of how VSS can lead to a better understanding of healthcare outcomes, both financial and health related. Financial outcomes in healthcare are not only subject to market forces, but also to legislation that governs reimbursement for services. The reimbursement process, itself, is confounded by error at multiple levels. This underscores the importance of understanding the challenges of healthcare reform and how to implement sound strategies for data management in clinical systems. The unique combination of JMP® and VSS enables healthcare leaders to do that successfully, with an intuitive approach to data analysis.

Methods

Measurement Systems Analysis & Response Modeling

A measurement systems analysis of DRG coding for CHF diagnoses was completed, followed by a retrospective chart review of 48 patients at a non-profit hospital in a small city of New Hampshire. Data was collected on 45 variables, after which a comparative analysis was performed through dynamic visualization of the relationships within and between variables, according to the Visual Six Sigma process:

![Visual Six Sigma Road Map](image)

Modeling the Response with Neural Nets and Recursive Partitioning

Variables with the most significant interactions were then used to develop predictive models to screen clients with CHF DRG codes for the likelihood of readmission. Both neural net and recursive partitioning models were designed to predict client readmissions.

Discussion: Measurement Systems Analysis of DRG Codes (291,292,293)

- 44% (21 of 48) of clients assigned CHF DRG codes for reimbursement were not admitted for CHF exacerbation. Similarly, in one study by board certified cardiologists, 49% of cases were misclassified (3). The 44% rate of readmissions due to CHF exacerbation was much higher than the reported 27% rate of clients readmitted within 30 days of discharge for CHF, because DRG codes poorly represent the CHF population.
- Errors can occur during the assignment of ICD-9 (ICD-10) codes by non-medical coders, or during the grouping process, performed by computer software (2).

Discussion

Analysis & Predictive Models for CHF Readmissions

- The majority of services are being used by a minority of clients, in terms of the number of readmissions.
- Predictive models can be used to forecast outcomes to assess the level of services needed after discharge (e.g. to enroll clients in disease management programs [DMP], rehabilitation, or be recommended to skilled nursing or hospice facilities).
- Interventions should be focused on clients’ particular comorbidities by developing multidisciplinary care plans that are based on predictive models, especially recursive partitioning models, because they form a natural decision tree that provides an intuitive interpretation of how to apply the models to real practice.

Reference


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