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Using Predictive Analysis to Optimize Pharmaceutical Marketing

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ABSTRACT

Most businesses have benefited from utilizing advanced analytics for marketing and other decision making. However, to apply analytical techniques for pharmaceutical marketing is challenging and emerging as it is critical to ensure the analysis makes sense from the medical side. Whether the drug for a specific disease finally consumed is directly and indirectly influenced by many factors including the disease origins, healthcare system policy, physician's clinical decisions and the patient's perceptions and behaviors. The key of pharmaceutical marketing is to identify the targeted populations for specific diseases and to focus on those populations. As the healthcare environment consistently changes, the predictive models are important to predict the change of the targeted population over time based on the patient journey and epidemiology. The time series analysis is used to forecast the number of cases of infectious diseases, correspondingly, over the counter and prescribed medicines for the specific disease could be predicted. The accurate prediction will provide valuable information for the strategic plan of campaigns.

For different diseases, the different analytic techniques shall be applied. By taking the medical features of the disease and epidemiology into account, the prediction of the potential and total addressable markets can reveal more insightful marketing trends. And by simulating the important factors and quantifying how they impact the patient journey within the typical healthcare system, the most accurate demand for specific medicines or treatments could be discovered. Through monitoring the parameters in the dynamic simulation, the smart decision can be made using what if comparisons to optimize the marketing result.

INTRODUCTION

In the changing healthcare environment, healthcare organizations and pharmaceutical companies are challenged by pressures to reduce costs, improve coordination and outcomes, and be more patient centric. The traditional marketing approaches (e.g. segmentation and promotion) that are used have evolved over time, but the combination of emerging digital applications and new regulation has increased the need for innovative solutions.

To shift in favor of patient-centric care requires a new approach to data and marketing. Pharmaceutical companies are forced to focus on expensive drugs for smaller patient populations, because for many common diseases-diabetes, heart disease, depression - there are now highly effective and incredibly cheap generic medications available (80% of drugs dispensed in the U.S. are generic). Using the advanced analytics to differentiate marketing plan, to see the future and drive revenue growth is demanded. Simulations and scenario testing combined with predictive modeling to forecast and simulate the future outcomes can quantify and provide the evidence to make the right decision. The advanced analytics shall focus on what you actually do for marketing – growth, which aligns with the measures from the marketing strategy. It is said that marketing is really all about acquisition and awareness all the way to retention and the full stack – it's all the layers of your funnel. The value of analytics is to identify and reach the largest amount of people to actually experience your product's value.

With the unprecedented growth of the complexity of both the business problems and the data structure, the analysis is getting more complex and requires more advanced tools to funnel down to the meaningful measures. The variety of SAS® Analytical Products provides the choices of the techniques and methods to conduct the complex multilevel analysis. SAS/STAT®, SAS/IML®, SAS/IML® Studio, SAS/ETS® and SAS/Enterprise Miner® can be integrated to solve problems for marketers and to support the real world

evidence. More advanced tools for specific areas, such as SAS® Decision Manager, SAS® Drug Development, SAS® Customer Intelligence, SAS® Episode Analytics, SAS® Marketing Operations Management, SAS® Decision Manager have also been developed.

The clinical research, market access, sales & marketing, clinical data transparency, real-world evidence and other solutions constitute the Life Science Analytics Framework. The analyses for market access could be used to understand a payer's ability to move market share, to predict how different decisions will affect reimbursement, volume and revenue, and to distribute compelling launch sequence and pricing insights to decision makers across the globe. (1,2) For sales & marketing, the analyses can be utilized for sales reporting, marketing analysis, physician targeting, social media analysis, digital asset management and marketing operations management. There already are some top pharmaceutical companies that have applied the analytics for their marketing.

INTEGRATED AND COMPREHENSIVE ANALYSIS

Currently, most of the marketing analyses are still segmenting by product, by therapeutic, by stage, by application, by route of administration, by end user and so on. But without meaningful combination and analysis of all the important factors, the analysis results would be separated and unilateral. In this complex system, it's necessary to merge the databases from various parts and analyze the data based on the practice processes. In this paper, two examples (diabetes and influenza) are explained to demonstrate how the pharmaceutical marketing analysis could move forward to optimize the decision-making.

DIABETES ANALYSIS EXAMPLE

A IMS Health analysis of EMR data reveals diabetes is the main consumer of GP resource among chronic conditions in Canada. (3) The burden of chronic disease on the health care system has increased the need to better understanding of the diabetes population. It is estimated that more than 5.7 million have prediabetes in Canada with total population of 35.16 million. Nearly 50 per cent of those with prediabetes will go on to develop type 2 diabetes. (4) Many people with prediabetes develop type 2 diabetes within 10 years. The question is not what the number will be in 10 years, but should be how the status would change? The government, health care providers, pharmaceutical companies, other therapeutic services, and lifestyle management are all involved in the diabetes monitoring and management. Type 2 diabetes is most often associated with older age and also associated with excess weight, physical inactivity, family history of diabetes, previous history of gestational diabetes, and certain ethnicities. (5) Blood tests involve drawing blood at a health care provider's facility and sending the sample to a lab for analysis are how the diabetes diagnosed. How are they diagnosed and treated in the healthcare system is what you want to know in order to provide your products to the targeted consumers. Working in the healthcare provider organization, our mission is to provide the patients the right care, at the right time. The claims data from insurance companies have been used for pharmaceutical marketing, however, the out of pocket medicine are missing for those are not covered by the insurance and for those who don't have insurance. The administrative data in healthcare system are the tremendous resource of the records of patients' diagnoses and treatments which are the core information of health status and history.

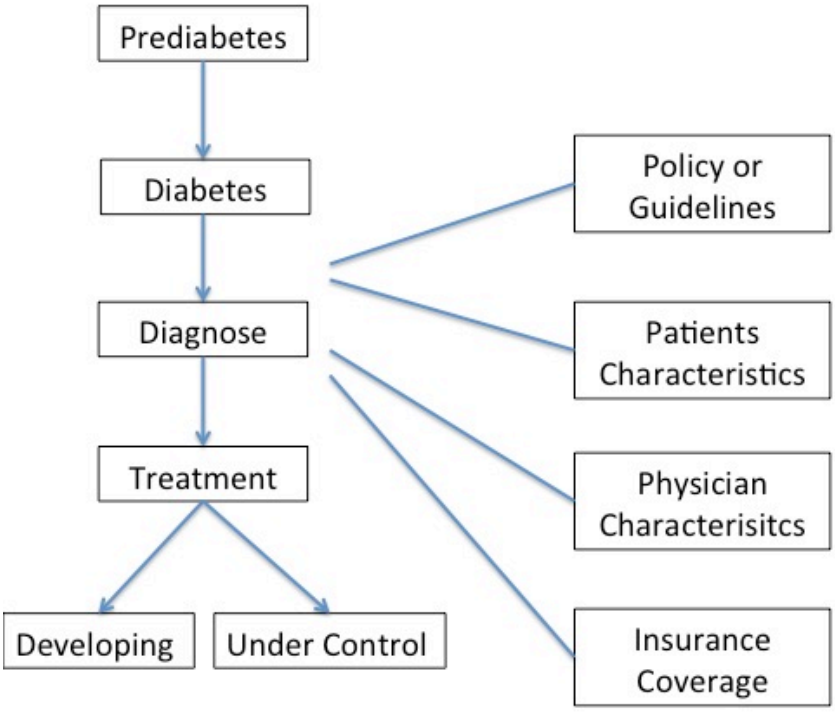

Figure 1. The brief overview of integrated analysis process of diabetes

Different databases capture different information depending on the purpose when the database is designed. Although for some databases in the healthcare system there are number of data elements captured in common especially the demographics, the samples in each database are different. Therefore, analysis of the data from different data sources is very useful to fully understand the entire view of specific population e.g. diabetes.

In the study *A Prediction Model to Estimate Completeness of Electronic Physician Claims Databases*, a prediction model was developed to estimate the prevalence of diabetes which was underestimated based on only one data source i.e. fee-for-service (FFS) electronic physician claims database. (6) A generalized linear model with a gamma distribution was used to model the number of diabetes cases per FFS physician as a function of physician characteristics. Then it is applied to the non-FFS physician to predict the diabetes cases that are not captured in the database to estimate the prevalence of the entire population in the province. The different number of diabetes cases diagnosed by physicians with the significant characteristics would be the most valuable for your sales strategy.

PROC GENMOD was applied to conduct the generalized linear model:

```
proc genmod data=FFS_Hospital_Provider_Uniq_R1;
      class REMUN_TYPE SPECIALTY_CAT SEX;
```

```
      model NUM_Diabetes = REMUN_TYPE SEX SPECIALTY_CAT SPECIALTY_YS;
      store out=R1_est;
run;
```

The common chronic diseases such as diabetes, depression, hypertension have large potential marketing size not only because these have high prevalence but also because of it's chronic with high risk of cormobodity. The underestimated prevalence of the diabetes indicates that there are potential larger marketing. However, with 80% drugs dispensed in US are generic, to grow in this area, new strategies shall be developed to better meet the patients' needs based on the subjective understanding the

An open and dynamic cohort study to identify subgroups of type 2 diabetes patients with trajectories of SBP (blood pressure). Identifying subgroups with distinct SBP trajectories helps to better understand the course of SBP levels in T2DM patients and its associated consequences. (7) In the study, four subgroups with distinct trajectories were identified. After about 5.7 years average follow-up period, the largest subgroup (85.6%) showed adequate SBP control (at or around 140 mmHg). The second subgroup (5.6%) were hypertensive in the first years, responded slowly to BP management and eventually reached SBP control. The third subgroup (3.4%) showed deteriorating hypertension during the first 4 years, then showed insufficient response to BP management. The fourth subgroup (5.4%) showed deteriorating hypertension over time. Patients within subgroups 2-4 were significantly older, comprised more women, used more antihypertensive medication and had a higher prevalence of retinopathy, microalbuminuria and cardiovascular disease mortality. In this study, latent class growth modeling (LCGM) as a flexible cluster analysis method is applied to identify the distinct subgroups based on the class baseline characteristics.

The LCGM is (the explanation of this model). And in SAS, the procedures to conduct the latent class modeling are PROC CALIS, PROC MIXED and PROC NLMIXED.

INFLUENZA ANALYSIS EXAMPLE

Influenza, also called flu, is a viral infection that attacks the respiratory system and associated with relatively high mortality. In the US from 1976 to 2007, annual influenza-associated deaths ranged from 3,349 (1985-86 season) to 48,614 (2003-04 season), with an average of 23,607 annual deaths. [错误! 未找到引用源。] The healthcare organizations and public health officials implement annual vaccination campaign to intervene influenza outbreak. Many countries have epidemiological surveillance systems using administrative databases to monitor and detect influenza epidemics.

The infectious disease has different epidemic features from the chronic disease. Especially, the influenza is seasonal. As the epidemic potential of influenza viruses depends mainly on their antigenic variations, virology laboratories have played a fundamental role in monitoring influenza. (8) There are many databases been utilized to monitor the influenza epidemic and therefore could be used to predict influenza cases. The databases could be public health integrated system, lab tests, vital statistics, sick-leave data collected from general practitioners or insurance systems, emergency admission, health service hotline and others. The time series modeling has been used for estimating the impact of influenza epidemic. (9,10) The study showed that epidemic level thresholds with an α level of 5% and 2.5% provided the same identification of influenza epidemic periods which was one week late compared with house calls or sick-leave indicators. And the time of the peak of influenza cases vary in different years, the peak of house calls or sick-leave indicators could be an indicator for the peak of drug consumption.

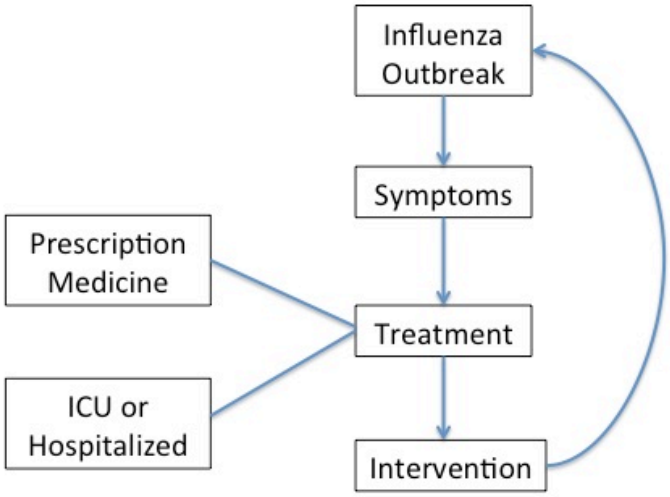

Figure 2. The brief overview of integrated analysis process of influenza

CONCLUSION

The case studies demonstrate how the predictive analysis has been applied into the healthcare field for various measures, which can be useful for the marketing plan for the products of specific disease. With the insights from the analysis based evidence, the greater marketing efficiency and accountability can be achieved. If the practice system could be identified and the analysis system could be developed, the high performance analysis products from SAS could also provide stable and efficient analysis infrastructure to advance the reporting capabilities. Better analysis infrastructure will ensure better understand physician prescribing behavior and make the most of each customer contact, therefore to optimize the marketing.

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