

Know Your Patients: A Model for Medication Adherence Behavior

Research Proposal

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The problem of poor medication adherence, which is generally defined as patients not taking medications as prescribed by their health care providers, is receiving increasing attention in the medical community and in the pharmaceutical industry. Recent articles in the *New England Journal of Medicine* (e.g., Osterberg and Blaschke 2005) and *DTC Perspectives* (e.g., Rubin 2006, Meadows 2006), a trade magazine for the pharmaceutical industry describe the gravity of this problem. From a public health perspective, poor medication adherence leads to worsening of illness, death and increased health care costs. Statistics shows that this problem accounts for 125,000 deaths per year and costs the U.S. health care system \$100 billion annually (Rubin 2006, Osterberg and Blaschke 2005). To pharmaceutical firms, poor adherence hurts the long term financial benefit of a drug, which is costly to produce. Meadows (2006) claimed that behind launching a new blockbuster medication, improving adherence was the second most important marketing strategy on which pharmaceutical firms should focus as it could generate a substantial return on investment.

In order to improve adherence, we need to have a proper measure of medication adherence. Having such a measure allows us to assess the degree of the problem, which may vary for different types of medications (chronic or acute) and different populations, and to have targeted intervention to specific patients. The current methods used in the medical community determine whether a patient is still on therapy, which is known as *persistence*, by taking in account the number and the dates of medications filled by a patient (Sikka et al. 2005). These methods are formulas that are simple to apply because they use pre-determined heuristics in the calculations. The outcome of these formulas is a dichotomous classification of whether a patient is persistent. However, these heuristics lack uniformity in the literature and none of them captures the sporadic pattern in medication refilling behavior, e.g., timeliness of refilling, long gaps between refills (Sikka et al. 2005). Another limitation of these simple measures is that they fail to recognize the non-contractual nature of medication refilling behavior. That is, a patient

(unless monitored closely) is not required to report to her health care providers (physician or pharmacist) when she stops taking a medication. But the current methods give a dichotomous and deterministic classification of persistency, which can lead to incorrect inference. Instead, a probabilistic measure of persistency should be used to describe the lack of adherence.

Models for non-contractual purchase behavior in marketing are not new. The prominent examples are the Pareto/NBD model and the BG/NBD model (Fader et al. 2005). However, they cannot be applied blindly to medication refilling behavior. These models assume a purchase can occur at any time whereas a refill cannot. A patient consumes her medicine before she refills again. As such, there is an additional constraint that is not presented in the traditional models.

To measure adherence properly, we propose a probability model to describe medication refilling behavior. The key feature of the model is that it captures different aspects of refilling behavior mentioned above and recognizes the non-contractual nature of the behavior. The model will be fit to patient-level prescription data in which the patients fill their medications at a nationwide retail pharmacy chain. It aims to produce a more appropriate and meaningful measure of adherence, which is a probabilistic score of persistency, for each patient in the database, given their medication history. This model aims to help health care providers, public health officials, and pharmaceutical companies to understand the problem of poor medication adherence at the aggregate level and have an individual-level estimate for targeted intervention.

Reference:

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