# Health Care Resource Utilization and Expenditures Associated with the Use of Insulin Glargine

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## ABSTRACT

**Background:** Newer insulins, such as long-acting analogues, offer promise of better glycemic control, reduced risk for diabetes complications, and moderation of health care use and costs.

**Objective:** We studied initiation of insulin glargine to evaluate its association with subsequent health service utilization and estimated expenditures.

**Methods:** Patients of the Veterans Health Administration, US Department of Veterans Affairs (VA) who initiated insulin glargine (n = 5064) in 2001–2002 were compared with patients receiving other insulin (n = 69,944), matched on prescription month (index date). Inpatient and outpatient VA care in the 12 months after a patient's index date was evaluated using Tobit regression, controlling for prior utilization, demographic characteristics, comorbidities, glycosylated hemoglobin ($HbA_{1c}$) levels, and diabetes severity. National average utilization costs and medication acquisition costs were used to estimate the value of VA expenditures.

**Results:** Compared with other insulin users, insulin glargine initiators had higher $HbA_{1c}$ values (8.72% vs 8.16%) prior to the index date, but greater subsequent $HbA_{1c}$ reduction (–0.50% vs –0.22%). After adjustment for age, prior utilization, $HbA_{1c}$ levels, and other factors, insulin glargine initiation was associated with 2.4 (95% CI, 1.1–3.7) fewer inpatient days for patients with any hospital admission (US $820 lower costs per initiator), 1.6 (1.2–1.9) more outpatient encounters ($279 higher costs per initiator), and $374 ($362–$387) higher costs for diabetes medications. The net difference was an average lower VA cost of $166 (–$290 to $622) per patient.

**Conclusions:** Insulin glargine use was associated with decreased inpatient days but increased outpatient care, and the value of the net change in utilization to VA offset the additional medication expenditures. Initiation of insulin glargine improves glycemic control and may reduce time in hospital without additional use of health resources. (*Clin Ther.* 2007;29:478–487)


**Key words:** diabetes, insulin, delivery of health care, health care costs.

## INTRODUCTION

Exogenous insulin is an effective means for managing blood glucose in most patients with diabetes and for reducing the risks for diabetes complications.[1–6] Despite this, insulin is underutilized in part because it requires careful management and there are concerns over hypoglycemia and other tolerability issues.[6,7] New long-acting insulin analogues may remedy some of these concerns and offer the promise of more effective and tolerable glycemic control. One such agent is insulin glargine, a long-acting, recombinant human insulin analogue that is given once daily, provides 24-hour basal insulin coverage with no pronounced activity peak, and has an activity pattern resembling that of endogenous insulin.[8,9] The lower and more stable glucose levels associated with insulin glargine

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use may be expected to result in lower risk for diabetes complications and better diabetes-related outcomes.

These benefits are suggested by clinical trials that have found efficacy in glycemic control and reduced incidence of hypoglycemia.[10–15] To further inform prescribing practices, health care providers and payers also need evaluations of medications in less controlled clinical settings with the more heterogeneous population of patients actually using the medication.[16] If these benefits are realized in actual practice, patients using insulin glargine would be expected to have improved glycemic control and its use would be expected to be associated with a lower incidence and milder severity of diabetes-related morbidity, less health service utilization, and lower health care costs.

We examined this issue in an observational study in patients with diabetes receiving care from the Veterans Health Administration, US Department of Veterans Affairs (VA). Parameters in patients initiating treatment with insulin glargine were compared with those in patients continuing to use other insulin. Glycemic control and health care resource utilization in the year following initiation were compared in the 2 study groups, controlling for relevant differences in the 2 populations at the time of initiation. With this design, we assessed whether insulin glargine initiation was associated with improved glycemic control and lower utilization, and we estimated the dollar values of utilization differences from the provider's perspective. We also assessed whether differences in utilization associated with insulin glargine use would at least offset the higher cost of the diabetes medication.

## MATERIALS AND METHODS

This research was conducted in the VA using nationally standardized electronic databases available for care of all VA patients.[17–19] These include: (1) VA inpatient and outpatient medical encounters obtained from the Austin Automation Center; (2) VA outpatient prescription records and shelf costs from the Pharmacy Benefits Management Strategic Healthcare Group; (3) laboratory test data from the Decision Support System; and (4) death records from the Beneficiary Identification and Record Locator file (a registry of all veterans whose families applied for VA death benefits[20]), supplemented by Social Security records. For this study, we used patient data from these sources that had been linked and processed for longitudinal analysis as part of the Diabetes Epidemiology Cohorts, a registry of all VA patients with diabetes since 1998.[21] This study was approved by the institutional review board at the VA Medical Center, Bedford, Massachusetts.

### Study Sample

We identified all patients prescribed insulin glargine in the VA from the time of its first use in April 2001 through September 2002, finding 5689 patients. We limited the sample to the 5317 patients whose insulin glargine use followed VA prescriptions for other insulin, as directed by VA guidelines.[22] We further restricted the sample to the 5064 veteran patients who survived at least 12 months after insulin glargine initiation and were still active users of the VA system, as indicated by an outpatient visit or inpatient stay at a VA facility.

The study was designed to test the effects of initiating insulin glargine according to VA guidelines. Accordingly, the comparison group was drawn from other patients with diabetes who were not prescribed insulin glargine as of September 2003, but who were prescribed other insulin. Each insulin glargine initiator was matched to other patients randomly chosen from the pool of veteran patients who had received a prescription for insulin in the same month and who survived and were active users of the system over the subsequent year. We used a matching ratio of 14:1 (except for the last 2 months, when it was 13:1), and the final comparison group included 69,944 patients.

An index date was assigned to each patient to define a period of characterization (the 12 months preceding the index date) and a period of observation (the 12 months following the index date). For insulin glargine initiators, this was the date of the first prescription for insulin glargine. For the comparison group, it was the date of the other insulin prescription in the month in which they were matched to an insulin glargine initiator. This resulted in similar distributions of index dates in the 2 study groups.

### Patient Measures

Glycosylated hemoglobin ($HbA_{1c}$) test results from the years before and after the index date were summarized in various ways. For the primary analysis, the last $HbA_{1c}$ test result up to 180 days before the index date was compared with the first $HbA_{1c}$ test result that was between 28 and 180 days after the index date (allowing some time for the new treatment to have an effect). Episodes of hypoglycemia during the charac-