

Treatment of poorly controlled type 2 diabetes (T2DM) patients with insulin glargine – An economic analysis

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Introduction

Diabetes mellitus (DM) is a major public health challenge affecting over 300,000 Singaporeans. Glycaemic control while demonstrated to be the best way to retard onset of complication is difficult to effect in practice and almost 30 per cent of diabetics on drug treatment have unacceptable control.¹

Insulin glargine, a long-acting insulin analogue enjoys a better physiological profile compared to intermediate-acting conventional neutral protamine Hagedorn (NPH) insulin and has been advocated for use in poorly controlled diabetics.

Objectives

This cost analysis examines the cost of DM treatment and related complications over a 5 year time horizon in uncontrolled Type 2 DM (T2DM) patients on NPH insulin versus insulin glargine.

Methods

A state transition model was used to simulate the progression of a cohort of 100 uncontrolled T2DM patients on NPH who were either continued on NPH or converted to insulin glargine over 5 years. Uncontrolled patients are defined as those not treated to a target HbA1c < 7%. In this simulation model based on previous published data, mean HbA1c level of uncontrolled patients on NPH is 9.0%.³ These patients can develop different diabetes-related complications, die from diabetes or other causes or remain in the existing state in each cycle (A cycle is defined as 1 year). Reduction in incidence rates of DM-related complications from improved HbA1c control if switched to glargine was estimated based on UKPDS data.^{2,3} The rate of severe hypoglycaemia was estimated from a study carried out in the US.⁴ Retrospective financial data on admissions for T2DM related complications admissions between 1 Jan 07 to 30 Sept 08 from a Singapore tertiary teaching hospital was used in estimating the cost of complications (in SGD\$) and insulin treatment. A 3% discount rate per annum was applied. The healthcare provider perspective was taken.

Figure 1 Model states and transitions in the diabetes simulation model

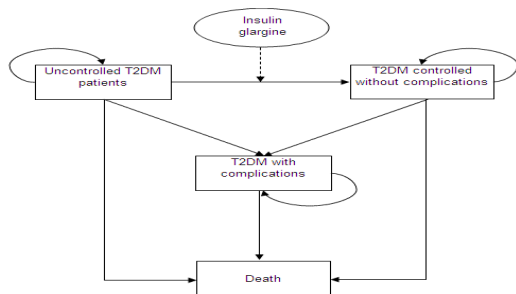


Table 1 Event rates in patients with type 2 diabetes with HbA1c between 8% to <9%

| Events | Incidence rate ² | Rate after HbA1c decrease ³ |
|-----------------------------------|-----------------------------|--|
| Myocardial infarction | 0.0160 | 0.0140 |
| Stroke | 0.0050 | 0.0045 |
| Microvascular | 0.0147 | 0.0098 |
| Heart failure | 0.0031 | 0.0027 |
| Amputation | 0.0014 | 0.0009 |
| | NPH (Episodes/patient/year) | Insulin glargine (Episodes/patient/year) |
| Severe hypoglycaemia ⁴ | 1.30 | 0.57 |

Table 2 Unit costs for each event in the first year and subsequent years

| Event | Cost (SGD\$ in 2008 values) | |
|-----------------------|-----------------------------|-------------------|
| | First year * | Following year ** |
| Myocardial infarction | \$ 3,126.15 | \$ 412.65 |
| Stroke | \$ 14,125.29 | \$ 3,654.21 |
| Microvascular | \$ 1,216.89 | \$ 231.21 |
| Retinopathy (90%) | \$ 751.48 | \$ - |
| Nephropathy (10%) | \$ 5,405.62 | \$ - |
| Heart failure | \$ 1,620.64 | \$ 1,620.64 |
| Amputation | \$ 4,127.67 | \$ 184.92 |
| Severe hypoglycaemia | \$ 757.22 | \$ - |

* Captures inpatient costs only.

** Estimated as a proportion of first year cost.⁵

Table 3 Cost breakdown for a diabetic patient on insulin treatment (NPH vs glargine)

| Resource item | Value of resource item (SGD\$) | | Remarks |
|--|--------------------------------|--------------------|---|
| | NPH | Insulin glargine | |
| Cost of insulin | \$ 478.88 | \$ 1,054.49 | Daily dose of insulin 32.8IU (NPH) vs 32.1IU (glargine) ⁶ |
| Cost of insulin needles | \$ 156.52 | \$ 156.52 | 31G fine insulin needle; once per day |
| Cost of lancet for blood glucose monitoring | \$ 62.40 | \$ 62.40 | Accucheck Advantage II (box of 200's) |
| Cost of glucose test strips | \$ 468.00 | \$ 468.00 | Box of 50's |
| Cost of HbA1c test | \$ 76.20 | \$ 76.20 | Once every 3 months |
| Cost of endocrinologist consultation | \$ 179.20 | \$ 128.00 | Total visits: 6 for uncontrolled vs 4 for controlled T2DM patients; initial visit takes 20 minutes, subsequent visit takes 10 minutes |
| Total cost per diabetic patient on insulin per year | \$ 1,421.20 | \$ 1,945.61 | |

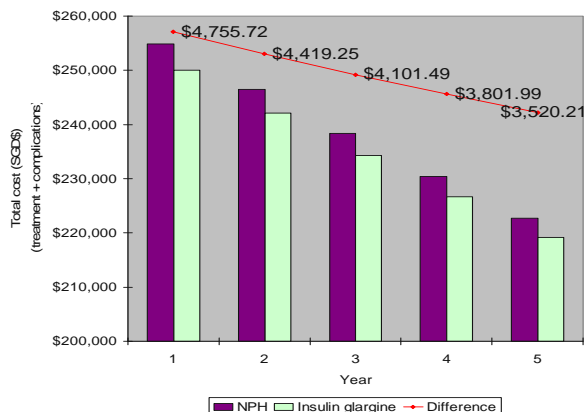
Results

Patients whose condition were uncontrolled on NPH and continued on NPH, incurred a higher total cost compared to if they were switched to insulin glargine. While the treatment cost for the 100 patients continued on NPH was \$648,457.27 versus \$891,872.38 after switching to glargine, the consequent lower rate of complications would lead to a reduction in costs of complications [\$544,508.38 (NPH) versus \$280,494.61 (glargine)]. Therefore, over a period of 5 years, cost of medical care would be \$20,598.66 more per 100 patients with uncontrolled T2DM continued on NPH (Fig 2).

Table 4 Cost of diabetes treatment and cost of complications due to diabetes over a 5 year period

| Year | NPH | | | Insulin glargine | | |
|--------------|-----------------------|--------------------------------|------------------------------------|-----------------------|--------------------------------|------------------------------------|
| | No. of patients alive | Cost of treatment SGD\$ ('000) | Cost of complications SGD\$ ('000) | No. of patients alive | Cost of treatment SGD\$ ('000) | Cost of complications SGD\$ ('000) |
| 1 | 100.0 | \$ 142.1 | \$ 112.7 | 100.0 | \$ 194.6 | \$ 55.5 |
| 2 | 98.4 | \$ 135.7 | \$ 110.9 | 98.6 | \$ 186.2 | \$ 55.9 |
| 3 | 96.7 | \$ 129.5 | \$ 108.9 | 97.2 | \$ 178.1 | \$ 56.2 |
| 4 | 95.1 | \$ 123.5 | \$ 107.0 | 95.8 | \$ 170.3 | \$ 56.4 |
| 5 | 93.4 | \$ 117.7 | \$ 105.0 | 94.3 | \$ 162.8 | \$ 56.4 |
| Total | | \$ 648.5 | \$ 544.5 | | \$ 892.0 | \$ 280.4 |

Figure 2 Total cost (treatment + complications) and the cost difference for a cohort of 100 patients over 5 years



Conclusion

Data from the model suggest insulin glargine is a cost-effective treatment option for uncontrolled T2DM patients on NPH in the long term. However, the finding should be validated by further analysis of actual outcomes data.

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