Rethinking Treatment Model for Type II Diabetes

Cost & Cost-Effectiveness

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Outline

- Principles of economic evaluation
- Self Monitoring of Blood Glucose (SMBG)
  - cost and budget impact
  - cost-effectiveness
- 2nd and 3rd line pharmacotherapy for T2DM
  - cost and budget impact
  - cost-effectiveness
- Other issues
  - optimal use and efficiencies
  - realizing opportunity cost
Principles of Economic Evaluation
Total Drug Expenditure in Canada

- Prescription medications are the fastest growing component of the Canadian health care budget
- Provincial drug plans under increasing financial pressure

CIHI 2010
Economic Evaluation

Relationship between:

- Resource use (numerator)
  - How much does it cost?
- Benefits (denominator)
  - Improved survival, quality of life
  - Does it improve health?
Opportunity Cost

• Relative scarcity
  • not enough resources to meet all the desires of a health care system

• CHOICE
  • Which programs / technologies to fund?
  • Which programs / technologies to forego?

“benefits foregone from program not implemented”
• Economics is **not** primarily about saving money

• **It is** about using scarce resources as **efficiently** as possible

• **Goal of Health Care Systems**

  ➡ Maximizing years of healthy life gained for a population at any given level of resource investment
Self Monitoring of Blood Glucose (SMBG)

Type II DM (not on insulin)
Self Monitoring of Blood Glucose (SMBG)  
**Type II DM (not on insulin)**

**Economic Impact:**
- >2 million Canadians with diabetes (and growing)
- Test strips in top 5 classes of total expenditure for drug plans
  - >$330 Million (public & private drug plans, 2006)

Significant use in Type II DM not on insulin
- Modest benefit (A1c reduction)
- Optimal frequency unclear
Test Strip use by Treatment of T2DM
Ontario Drug Benefit Program 2006

OAD + Insulin
$18,078,903 (17%)

Insulin
$22,437,720 (21%)

OAD
$56,597,805 (51%)

No Pharmacotherapy for Diabetes
$12,296,937 (11%)
SMBG use by Treatment of T2DM
Private Drug Plans, Canada 2006

- **OAD**
  - $29,791,027 (36%)
- **Insulin + OAD**
  - $11,324,220 (14%)
- **Pharmacotherapy for Diabetes**
  - $7,778,477 (10%)
- **Insulin**
  - $32,910,753 (40%)
### Table 4: Summary of Meta-Analytic Results Across RCTs Comparing SMBG Versus No SMBG in Adults With Type 2 Diabetes Treated With Oral Antidiabetes Drugs or No Pharmacotherapy — Overall Results, Sensitivity Analyses, and Subgroup Analyses for Mean A1C (%) (Change From Baseline)

<table>
<thead>
<tr>
<th>Analysis</th>
<th>Number of Studies (sample size)</th>
<th>WMD (95% CI) in A1C (%)</th>
<th>I² (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Overall</strong></td>
<td>7 RCTs (^4,28,29,34,37,39,50) (n = 2,270)</td>
<td>-0.25 (-0.36, -0.15)</td>
<td>0</td>
</tr>
<tr>
<td><strong>Sensitivity analyses</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good quality RCTs only</td>
<td>3 RCTs (^34,39,50) (n = 1,247)</td>
<td>-0.21 (-0.34, -0.08)</td>
<td>0</td>
</tr>
<tr>
<td>RCTs in which all subjects used OADs</td>
<td>3 RCTs (^28,34,50) (n = 1,628)(^\ast)</td>
<td>-0.24 (-0.36, -0.11)</td>
<td>0</td>
</tr>
</tbody>
</table>

\(^\ast\) Reference to specific studies not provided in this excerpt.
SMBG in Type II DM
Systematic Review

- Main outcome surrogate (HbA1c)
  - statistically significant although clinically modest effect in subjects not using insulin
- Lack of data on other outcomes
  - Diabetes-related outcomes, mortality
  - Quality of life
  - Subgroups that may benefit more
SMBG in Type II DM (not on insulin):
Economic Evaluation: UKPDS Model

- Intervention: SMBG
- RCT endpoint: A1c
- Association of A1c and DM complications
- Mortality, QOL, Costs
SMBG in Type II DM (not on insulin): Economic Evaluation

United Kingdom Prospective Diabetes Study (UKPDS) Outcomes model

- long-term health outcomes & cost consequences forecast
- estimates risk of diabetes related complications (A1c)
  - cost and quality of life decrements
- validated using published clinical and epidemiological studies

Cameron, Coyle, Ur, Klarenbach CMAJ 2010
SMBG in Type II DM (not on insulin): Economic Evaluation: UKPDS Model

CompuS defines:
- simulation conditions
- cohort characteristics
- treatment regimen SMBG use / frequency

Start Annual Cycle

UKPDS Outcomes Model

Update simulation history (e.g., event history, age, etc.)

Randomly order and run event risk equations:
1. MI
2. Angina
3. IHD
4. Stroke
5. Amputation
6. Blindness
7. Renal failure
8. Diabetes-related mortality
9. Other mortality

Patient dead?

Calculate costs, life-years, QALYs for each cohort

Yes

Mortality, QOL, Costs

No
### Table 3: Benefits, costs and incremental cost utility ratios for self-monitoring blood glucose levels among patients with type 2 diabetes not using insulin*

<table>
<thead>
<tr>
<th>Measure</th>
<th>No self-monitoring</th>
<th>Self-monitoring</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Life years gained</td>
<td>9.87038</td>
<td>9.89812</td>
<td>0.028</td>
</tr>
<tr>
<td>Quality-adjusted life years gained</td>
<td>7.29806</td>
<td>7.32191</td>
<td>0.024</td>
</tr>
<tr>
<td>Total direct costs, Can$</td>
<td>27 997</td>
<td>30 708</td>
<td>2 711</td>
</tr>
<tr>
<td>Incremental cost per life-year gained</td>
<td></td>
<td></td>
<td>97 729‡</td>
</tr>
<tr>
<td>Incremental cost per quality-adjusted life-year gained</td>
<td></td>
<td></td>
<td>113 643§</td>
</tr>
</tbody>
</table>

Cameron, Coyle, Ur, Klarenbach CMAJ 2010
### Economic Evaluation Results: Sensitivity Analysis

<table>
<thead>
<tr>
<th>Analysis</th>
<th>ICUR (Can$/QALY)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reference case</strong></td>
<td>113 643</td>
</tr>
<tr>
<td><strong>One-way sensitivity analyses</strong></td>
<td></td>
</tr>
<tr>
<td>Lower limit of 95% CI for WMD in HbA(<em>{1c}) from 7 RCTs(^{25,31}) ((\Delta HbA</em>{1c}) = 0.39%)</td>
<td>77 706</td>
</tr>
<tr>
<td>Upper limit of 95% CI for WMD in HbA(<em>{1c}) from 7 RCTs(^{25,31}) ((\Delta HbA</em>{1c}) = 0.15%)</td>
<td>189 376</td>
</tr>
<tr>
<td>WMD in HbA(<em>{1c}) from good-quality RCTs(^{25,28,31}) ((\Delta HbA</em>{1c}) = 0.21%)</td>
<td>133 829</td>
</tr>
<tr>
<td>(\Delta HbA_{1c}) estimate from observational study(^{32}) ((\Delta HbA_{1c}) = 0.57%)</td>
<td>47 512</td>
</tr>
<tr>
<td>WMD in HbA(<em>{1c}) from RCTs(^{26,30}) that used intensive education* ((\Delta HbA</em>{1c}) = 0.28%)</td>
<td>99 916</td>
</tr>
<tr>
<td>Price per test strip reduced by 25% (Can$0.55/strip)</td>
<td>86 129</td>
</tr>
<tr>
<td>Price per test strip reduced by 50% (Can$0.36/strip)</td>
<td>58 615</td>
</tr>
<tr>
<td>Price per test strip reduced by 75% (Can$0.18/strip)</td>
<td>31 101</td>
</tr>
<tr>
<td>Lowest price per test strip in Ontario Drug Benefits Program (Can$0.40/strip)</td>
<td>63 892</td>
</tr>
<tr>
<td>Alternative formulary list price (Can$0.81/strip)</td>
<td>123 143</td>
</tr>
<tr>
<td>History of diabetes-related complications reflective of patients in the DICE study and Canadian diabetes atlases(^{19,33})</td>
<td>89 656</td>
</tr>
<tr>
<td>No. of tests per week(^{\dagger})</td>
<td></td>
</tr>
<tr>
<td>1 (0.14/day)(^{34})</td>
<td>6 322</td>
</tr>
<tr>
<td>2 (0.29/day)(^{34})</td>
<td>19 571</td>
</tr>
<tr>
<td>4 (0.57/day)(^{34})</td>
<td>46 445</td>
</tr>
<tr>
<td>7 (1/day)(^{35})</td>
<td>86 168</td>
</tr>
<tr>
<td>12 (1.71/day)(^{28,30})</td>
<td>152 095</td>
</tr>
<tr>
<td><strong>Two-way sensitivity analyses</strong></td>
<td></td>
</tr>
<tr>
<td>Self-monitoring &lt; 1/day, ((\Delta HbA_{1c}) = 0.20%; frequency = 0.77/day)(^{25-27})</td>
<td>81 654</td>
</tr>
<tr>
<td>Self-monitoring 1–2/day, ((\Delta HbA_{1c}) = 0.26%; frequency = 1.46/day)(^{79,31})</td>
<td>122 416</td>
</tr>
<tr>
<td>Self-monitoring &gt; 2/day, ((\Delta HbA_{1c}) = 0.47%; frequency = 3.5/day)(^{28,30})</td>
<td>169 120</td>
</tr>
<tr>
<td>Baseline HbA(<em>{1c}) &lt; 8.0% (WMD in HbA(</em>{1c}) % = 0.16%, baseline HbA(_{1c}) = 7.5%)</td>
<td>213 503</td>
</tr>
<tr>
<td>Baseline HbA(<em>{1c}) 8.0%–10.5% (WMD in HbA(</em>{1c}) % = 0.30%, baseline HbA(_{1c}) = 8.7%)</td>
<td>94 443</td>
</tr>
<tr>
<td><strong>Multi-way sensitivity analyses</strong></td>
<td></td>
</tr>
<tr>
<td>Patients using OADs, 3 RCTs(^{26,27,31})(^\dagger)</td>
<td>91 724</td>
</tr>
<tr>
<td>Patients using insulin,(^{34,35}) 1 RCT(^{26,27,31})</td>
<td>91 693</td>
</tr>
<tr>
<td>Patients using diet-only therapy,(^{\dagger\dagger}) 1 RCT(^{13})</td>
<td>292 144</td>
</tr>
</tbody>
</table>
Sensitivity Analysis: HbA1c and Test Frequency

### Two-way sensitivity analyses

<table>
<thead>
<tr>
<th></th>
<th>Change in HbA1c</th>
<th>Frequency</th>
<th>Cost Effectiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-monitoring &lt; 1/day</td>
<td>$\Delta$HbA1c = -0.20%; frequency = 0.77/day</td>
<td>$\Delta$HbA1c = -0.20%; frequency = 0.77/day</td>
<td>81,654</td>
</tr>
<tr>
<td>Self-monitoring 1–2/day</td>
<td>$\Delta$HbA1c = -0.26%; frequency = 1.46/day</td>
<td>$\Delta$HbA1c = -0.26%; frequency = 1.46/day</td>
<td>122,416</td>
</tr>
<tr>
<td>Self-monitoring &gt; 2/day</td>
<td>$\Delta$HbA1c = -0.47%; frequency = 3.5/day</td>
<td>$\Delta$HbA1c = -0.47%; frequency = 3.5/day</td>
<td>169,120</td>
</tr>
</tbody>
</table>

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Cameron, Coyle, Ur, Klarenbach CMAJ 2010
Sensitivity Analysis:
Cost of Test Strip

Cameron, Coyle, Ur, Klarenbach CMAJ 2010
Blood Glucose Monitoring in Type II DM (not on insulin): Economic Evaluation

- Generally unattractive incremental cost-effectiveness ratios
- May be reasonable value if:
  - price of test strips reduced
  - reduced frequency of use

Reduced utilization of SMBG test strips would lead to significant cost savings
- resources (~$150 M) diverted to more cost-effective interventions
- minimal if any impact on health

Cameron, Coyle, Ur, Klarenbach CMAJ 2010
2nd and 3rd line therapy for T2DM
2nd line therapy for T2DM

- Consensus on 1st line therapy (metformin)
  - clinically effective, low cost
- Numerous 2nd line agents
  - recent introduction of numerous second line agents in Canada
### Cost of 2nd and 3rd line therapy for T2DM

<table>
<thead>
<tr>
<th>Therapy</th>
<th>Cost/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glyburide — 10 mg/day</td>
<td>$0.12</td>
</tr>
<tr>
<td>Gliclazide — 160 mg/day</td>
<td>$0.19</td>
</tr>
<tr>
<td>Gliclazide modified-release (MR) — 60 mg/day</td>
<td>$0.28</td>
</tr>
<tr>
<td>Glimepiride&lt;sup&gt;*&lt;/sup&gt; — 4 mg/day</td>
<td>$0.49</td>
</tr>
<tr>
<td>Acarbose — 200 mg/day</td>
<td>$0.72</td>
</tr>
<tr>
<td>Meglitinide (Repaglinide)&lt;sup&gt;†&lt;/sup&gt; — 4 mg/day</td>
<td>$0.76</td>
</tr>
<tr>
<td>Insulin NPH&lt;sup&gt;†&lt;/sup&gt; — 40 units/day</td>
<td>$1.09</td>
</tr>
<tr>
<td>Long-acting insulin analogue (glargine)&lt;sup&gt;‡&lt;/sup&gt; — 32 units/day</td>
<td>$1.85</td>
</tr>
<tr>
<td>Biphasic human insulin 30/70&lt;sup&gt;‡&lt;/sup&gt; — 70 units/day</td>
<td>$1.86</td>
</tr>
<tr>
<td>Biphasic insulin analogue (aspart 30/70)&lt;sup&gt;‡&lt;/sup&gt; — 60 units/day</td>
<td>$2.08</td>
</tr>
<tr>
<td>Pioglitazone&lt;sup&gt;‡&lt;/sup&gt; — 30 mg/day</td>
<td>$2.20</td>
</tr>
<tr>
<td>Sitagliptin — 100 mg/day</td>
<td>$2.81</td>
</tr>
<tr>
<td>Rosiglitazone — 8 mg/day</td>
<td>$3.09</td>
</tr>
</tbody>
</table>

- Dramatic variation in daily costs
- Recent introduction of newer agents (more costly)
Drug Expenditure Oral Anti-Hyperglycemic Agents

- From 1998 to 2009
  - Private: $7 to $123 M
  - Public (RAMQ): $13 to $55 M
- 4 to 17 x increase in expenditure

What are the drivers of growth?
Drug Expenditure Oral Anti-Hyperglycemic Agents
Private Drug Plans 1998-2009
Drug Expenditure Oral Anti-Hyperglycemic Agents
Quebec public drug plan 1998-2009

- March 2000 - NOC issued for rosiglitazone
- Aug 2000 - NOC issued for pioglitazone
- Jan 2008 - NOC issued for sitagliptin
- Sep 2010 - NOC issued for saxagliptin
# Drug Expenditure Oral Anti-Hyperglycemic Agents

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Metformin</td>
<td>59%</td>
<td>33%</td>
</tr>
<tr>
<td>Sulphonylureas</td>
<td>23%</td>
<td>10%</td>
</tr>
<tr>
<td>TZDs</td>
<td>11%</td>
<td>38%</td>
</tr>
<tr>
<td>DPP-4 Inhibitors</td>
<td>4%</td>
<td>15%</td>
</tr>
</tbody>
</table>

1 patient treated with TZD or DPP-4 inhibitor = 8-12 patients treated with sulphonylurea.
Drug Expenditure Oral Anti-Hyperglycemic Agents

- Widespread adoption of newer, costlier agents
  - Are the benefits worth the additional cost?
Cost-Effectiveness of 2nd line agents in Type II DM

Clinical evidence / inputs

- \( A1c \rightarrow \) little differences between agents
- Hypoglycemia \( \rightarrow \) differences (low absolute risk)
- Weight change \( \rightarrow \) differences (clinical relevance)
- Side effects \( \rightarrow \) CHF, Fractures, GI symptoms, etc

Costs

- treatment \( \rightarrow \) drug ± test strips
- side effects
- diabetes related complications
Cost-Effectiveness Model of 2nd line agents in Type II DM

COMPUS defines:
- simulation conditions
- cohort characteristics
- treatment regimen
  A. Metformin only
  B. Metformin and:
    1. Sulphonylureas
    2. Meglitinides
    3. AGI
    4. TZD
    5. DPP-4 inhibitors
    6. Basal insulin
    7. Biphasic insulin

Start Annual Cycle

UKPDS Outcomes Model

Update simulation history (e.g., event history, age, etc.)

Patient dead?

Yes: Calculate costs, life-years, QALYs for each cohort

No: Randomly order and run event risk equations:
  1. MI
  2. Angina
  3. IHD
  4. Stroke
  5. Amputation
  6. Blindness
  7. Renal failure
  8. Diabetes-related mortality
  9. Other mortality

Submodels:
- mild/moderate hypoglycemia
- severe hypoglycemia
- CHF/Fractures

For metformin monotherapy vs. metformin and additional therapy COMPUS calculates:
- incremental cost
- incremental QALY
- incremental cost per QALY
- cost-effectiveness acceptability curves
## Cost-Effectiveness of 2nd line agents in Type II DM

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Average costs</th>
<th>Average QALYs</th>
<th>Incremental cost (metformin)</th>
<th>Incremental QALYs (metformin)</th>
<th>Incremental Cost Effectiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metformin</td>
<td>$39,924</td>
<td>8.7194</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Sulphonylureas</td>
<td>$40,669</td>
<td>8.7777</td>
<td>$745</td>
<td>0.0583</td>
<td>$12,757 per QALY (relative to metformin)</td>
</tr>
<tr>
<td>Meglitinides</td>
<td>$42,269</td>
<td>8.7682</td>
<td>$2,345</td>
<td>0.0488</td>
<td>Meglitinides dominated by sulfonylureas</td>
</tr>
<tr>
<td>α-glucosidase inhibitors</td>
<td>$42,797</td>
<td>8.78</td>
<td>$2,873</td>
<td>0.0606</td>
<td>$939,479 per QALY (relative to sulfonylureas)</td>
</tr>
<tr>
<td>TZDs</td>
<td>$46,202</td>
<td>8.7807</td>
<td>$6,278</td>
<td>0.0614</td>
<td>$4,621,828 per QALY (relative to alpha-glucosidase inhibitors)</td>
</tr>
<tr>
<td>DPP-4 Inhibitors</td>
<td>$47,191</td>
<td>8.7795</td>
<td>$7,267</td>
<td>0.0601</td>
<td>DPP-4 inhibitors dominated by TZD†</td>
</tr>
<tr>
<td>Basal Insulin</td>
<td>$47,348</td>
<td>8.7686</td>
<td>$7,424</td>
<td>0.0492</td>
<td>Basal insulin dominated by TZD†</td>
</tr>
</tbody>
</table>
Cost-Effectiveness Acceptability Curve of 2nd line agents in Type II DM

Results robust in sensitivity / scenario analysis
Cost-Effectiveness of 2nd line agents in Type II DM

- Compared to addition of sulphonylurea
  - little difference in control of diabetes
  - hypoglycemia played small role given low absolute risk in this patient population
  - substantial increase in costs

→ Addition of sulphonylurea as second line agent most cost-effective strategy
3rd Line Agents

• What next after Metformin + sulphonylurea?

• Similar approach taken as 2nd line agents

• Compared addition of:
  • basal insulin (NPH or long acting analogue)
  • biphasic insulin
  • Thiazolidinediones (TZDs)
  • DPP-4 inhibitors
Cost-Effectiveness of 3rd line agents in Type II DM

Clinical evidence / inputs

- A1c \rightarrow\ differences between agents
- Hypoglycemia \rightarrow\ differences (low absolute risk)
- Weight change \rightarrow\ differences (clinical relevance)
- Side effects \rightarrow\ CHF, Fractures, GI symptoms, etc

Costs

- treatment \rightarrow\ drug ± test strips
  - average defined daily dose (oral agents)
  - convenience sample of patients using insulin
- side effects
- diabetes related complications
## Average daily cost

<table>
<thead>
<tr>
<th>Class (including test strips)</th>
<th>Average daily cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulin NPH</td>
<td>$3.60</td>
</tr>
<tr>
<td>TZD (generic pioglitazone)</td>
<td>$3.81</td>
</tr>
<tr>
<td>Long acting insulin analogues</td>
<td>$4.69</td>
</tr>
<tr>
<td>Biphasic human insulin (lowest cost)</td>
<td>$5.45</td>
</tr>
<tr>
<td>TZD (rosiglitazone)</td>
<td>$5.92</td>
</tr>
<tr>
<td>Biphasic insulin analogue</td>
<td>$5.98</td>
</tr>
<tr>
<td>Treatment versus Placebo plus Metformin plus a Sulfonylurea</td>
<td>Effect Estimates (95% CrI)</td>
</tr>
<tr>
<td>------------------------------------------------------------</td>
<td>----------------------------</td>
</tr>
<tr>
<td>**a) Change from baseline **AIC (%)</td>
<td></td>
</tr>
<tr>
<td>Basal insulin + Met + SU</td>
<td>$-1.17 (-1.57$ to $-0.81)$</td>
</tr>
<tr>
<td>Biphasic insulin + Met + SU</td>
<td>$-1.10 (-1.59$ to $-0.67)$</td>
</tr>
<tr>
<td>TZD + Met + SU</td>
<td>$-0.96 (-1.35$ to $-0.59)$</td>
</tr>
<tr>
<td>DPP-4 (sitagliptin) + Met + SU</td>
<td>$-0.89 (-1.51$ to $-0.26)$</td>
</tr>
<tr>
<td>**b) Change from baseline **body weight (kg)</td>
<td></td>
</tr>
<tr>
<td>Basal insulin + Met + SU</td>
<td>$1.85 (0.54$ to $3.09)$</td>
</tr>
<tr>
<td>Biphasic insulin + Met + SU</td>
<td>$3.35 (1.65$ to $5.03)$</td>
</tr>
<tr>
<td>TZD + Met + SU</td>
<td>$3.10 (1.73$ to $4.43)$</td>
</tr>
<tr>
<td>DPP-4(sitagliptin) + Met + SU</td>
<td>$1.11 (-1.36$ to $3.57)$</td>
</tr>
<tr>
<td>**c) Overall **hypoglycemia</td>
<td></td>
</tr>
<tr>
<td>Basal insulin + Met + SU versus Met + SU + placebo</td>
<td>RR $1.73 (1.10$ to $2.74)$</td>
</tr>
<tr>
<td>TZD + Met + SU versus Basal Insulin + Met + SU</td>
<td>RR $0.65 (0.48$ to $0.88)$</td>
</tr>
<tr>
<td>Biphasic + Met + SU versus Basal Insulin + Met + SU</td>
<td>RR $1.24 (1.14$ to $1.35)$</td>
</tr>
<tr>
<td>DPP-4 inhibitor + Met + SU versus Met + SU + placebo*</td>
<td>RR $18.51 (2.52$ to $135.96)$</td>
</tr>
</tbody>
</table>
## Cost-Effectiveness of 3rd line agents in Type II DM

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Average costs</th>
<th>Average QALYs</th>
<th>Incremental cost (Met+ SU)</th>
<th>Incremental QALYs (Met +SU)</th>
<th>Incremental Cost Effectiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Met + SU</td>
<td>39,128</td>
<td>8.2405</td>
<td></td>
<td></td>
<td>NA</td>
</tr>
<tr>
<td>Met + SU + Basal Insulin</td>
<td>44,206</td>
<td>8.3251</td>
<td>$5078</td>
<td>0.085</td>
<td>$60,049 per QALY gained (relative to Met + SU)</td>
</tr>
<tr>
<td>Met + SU + DPP-4 (sitagliptin)</td>
<td>44,717</td>
<td>8.3059</td>
<td>$5580</td>
<td>0.065</td>
<td>Dominated by Met + SU + Basl</td>
</tr>
<tr>
<td>Met + SU + TZD*</td>
<td>45,936</td>
<td>8.2191</td>
<td>$6808</td>
<td>-0.021</td>
<td>Dominated by Met + SU + Basl</td>
</tr>
<tr>
<td>Met + SU + Biphasic Insulin</td>
<td>48,317</td>
<td>8.3198</td>
<td>$9189</td>
<td>0.079</td>
<td>Dominated by Met + SU + Basl</td>
</tr>
</tbody>
</table>

*TZD*: Thiazolidinediones.
Cost-Effectiveness Acceptability Curve of 3rd line agents in Type II DM
Cost-Effectiveness of 3rd line agents in Type II DM

Sensitivity Analysis

Greater disutility of mild - moderate hypoglycemia
→ DPP-4 inhibitors ($90,000 / QALY gained)

Higher rate of severe hypoglycemia
→ DPP-4 inhibitors ($85,600 / QALY gained)

Disutility of insulin injections
→ DPP-4 inhibitors ($85,600 / QALY gained)

Weight gain leads to disutility
→ basal insulin ($75,500 / QALY gained)

RCT dose of insulin
→ basal insulin ($37,600 / QALY gained)
Cost-Effectiveness of 3rd line agents in Type II DM

Addition of NPH insulin most cost-effective therapy

• limited by quality of evidence

• some scenarios where DPP-4 inhibitors may be preferred

• sensitivity analysis not base case

• lower quality of underlying data

• less known regarding long term safety / side-effects
Conclusions

Thorough analysis of treatment strategies in T2DM

- significant budget impact
- minimal effectiveness
- unfavourable cost-effectiveness for SMBG and newer anti-diabetes agents

Efficiency

- reduction in costly strategies that have little impact on health aligns with health care system sustainability

Opportunity cost

- resources deployed to strategies with much more favourable impact on health