Systematic Literature Review of Costs Related to Patients With Type 2 Diabetes Mellitus Experiencing a Stroke or Myocardial Infarction

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BACKGROUND
• Type 2 diabetes mellitus (T2DM) is a metabolic disorder that puts patients at increased risk of myocardial infarction (MI) or stroke compared with patients without diabetes and contributes to a higher rate of death and disability.

OBJECTIVE
To review published cost estimates of stroke and MI in patients with T2DM to better understand the associated economic burden.

METHODS
• A systematic literature review was conducted in PubMed, Embase, and the Cochrane Library (2001-2011) conference abstracts (2009-2011); bibliographies of included studies; and review articles, using medical subject heading terms and title words for stroke, MI, and T2DM.

Inclusion Criteria
• Studies presenting costs related to MI and/or stroke for patients with T2DM.

Exclusion Criteria
• Studies not meeting the inclusion criteria, no cost outcomes, publication type was not of interest (reviews were excluded, but examined for relevant publication).

Data Extraction
• Costs attributed to other publications were traced to original sources, and these costs were included.

RESULTS
• Of 1,399 records screened, 51 cost studies were included (Figure 1).

**Costs Attributed to Other Publications**

<table>
<thead>
<tr>
<th>Country</th>
<th>Cost (GBP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>United Kingdom</td>
<td>12,000</td>
</tr>
<tr>
<td>United States</td>
<td>20,000</td>
</tr>
</tbody>
</table>

MI Costs
• Fourty-seven studies reported costs for an MI in patients with T2DM. Eleven were primary cost studies (1 of which was a burden of illness study that estimated annual direct cost per patient and the cost of treating diabetes and microvascular complications). Thirteen MI-related complications were identified.

Primary Cost Studies
• One of the 11 studies estimated the impact of diabetes-related complications, including MI, N. In the UK and was based on the data collected from 5,102 patients in the UK Prospective Diabetes Study. The estimated annual hospital inpatient costs for a fatal MI corresponded to £2,480.

Economic Evaluations
• Eighteen of the 36 studies included costs for a fatal MI, and all of these costs corresponded to the year of the MI.

Thirteen cost estimates ranged from £1,594 to £5,549. However, a study from the United States (US) reported a cost of £14,255.

Secondary MI/Year of the Event
• Thirteen of the cost studies reported an annual cost for an MI. All 13 studies reported at least one cost per year of the MI.

Primary Cost Studies
• The 13th MI study estimated a national annual cost of £2,480, which corresponds to the year of the MI.

Economic Evaluations
• All economic evaluations included the cost of the MI for the year of the MI. The 13th MI study estimated a national annual cost of treatment for patients with T2DM who experience an MI, which in total is £5,849.

The Cost of a Nonfatal MI in the Year of the Event and of Annual Follow-up From Primary Cost Studies

<table>
<thead>
<tr>
<th>Year</th>
<th>Cost (GBP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year of MI</td>
<td>1,594</td>
</tr>
<tr>
<td>Year 1</td>
<td>1,845</td>
</tr>
<tr>
<td>Year 2</td>
<td>2,000</td>
</tr>
<tr>
<td>Year 3</td>
<td>2,150</td>
</tr>
<tr>
<td>Year 4</td>
<td>2,300</td>
</tr>
<tr>
<td>Year 5</td>
<td>2,450</td>
</tr>
</tbody>
</table>

Of the 47 studies reporting costs for a MI, 45 studies reported either a cost per nonfatal MI or a cost for the year of the MI.

• Of these, 31 primary cost studies and 36 economic evaluations.

Primary Cost Studies
• One of the primary cost studies estimated direct costs for a fatal stroke. Clarke et al evaluated these for seven countries and ranged between £72 to £211. The lowest estimated costs were reports for Sweden (no detail on included resources), and the highest for Canada (range, £846 to £176).

Stroke Costs
• Forty-six studies reported costs for a stroke in patients with T2DM. Of these, 11 were primary cost studies, and 35 were economic evaluations.

Primary Cost Studies
• One of the 11 primary cost studies estimated direct costs for a fatal stroke. Clarke et al evaluated these for seven countries and ranged between £72 to £211. The lowest estimated costs were reports for Sweden (no detail on included resources), and the highest for Canada (range, £846 to £176).

The 13th MI study estimated a national annual cost of £2,480, which corresponds to the year of the MI.

The Cost of a Stroke in the Year of the Event and of Annual Follow-up From Primary Cost Studies

<table>
<thead>
<tr>
<th>Year</th>
<th>Cost (GBP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year of Stroke</td>
<td>1,605</td>
</tr>
<tr>
<td>Year 1</td>
<td>1,750</td>
</tr>
<tr>
<td>Year 2</td>
<td>1,895</td>
</tr>
<tr>
<td>Year 3</td>
<td>2,040</td>
</tr>
<tr>
<td>Year 4</td>
<td>2,185</td>
</tr>
<tr>
<td>Year 5</td>
<td>2,330</td>
</tr>
</tbody>
</table>

Of the 46 studies reporting costs for a stroke, 45 studies reported either a cost per nonfatal stroke or a cost for the year of the stroke.

• Of these, 31 primary cost studies and 36 economic evaluations.

Primary Cost Studies
• Fourteen of the 36 studies included costs for a fatal MI, and all of these costs corresponded to the year of the MI.

Economic Evaluations
• All 36 economic evaluations included direct costs for the year of the stroke. Estimates ranged from £1,008 to £46,683.

None of the identified cost studies reported disaggregated cost components.

• None of the identified cost studies reported indirect costs associated with an MI or stroke in patients with T2DM.

• None of the cost studies estimated indirect costs in terms of premature mortality for a fatal MI or stroke.

• None of the studies provided cost estimates for a nonfatal stroke.

• None of the identified cost estimates contributed to the severity of the MI or stroke.

The source of cost estimates used in the 40 economic evaluations varied, with 10 of the economic evaluations using 1 of the primary studies as a source. Four other studies used costs estimated in studies not specific to patients with T2DM.

Further, high-quality cost studies are needed to report disaggregated cost components, which would allow the reader to gain a greater insight into the individual cost components, explore the differences in clinical practice and resource use, and gain insight into true differences between cost estimates.

CONCLUSIONS
• Literature on costs for MI and stroke in patients with T2DM is sparse, and studies have been performed in only a few countries.

• The ranges of costs for MI and stroke are broad both within and between countries.

• Further studies are needed to provide reliable cost estimates by severity of MI or stroke in patients with T2DM.

Economic Evaluations
• None of the economic evaluations identified estimated indirect costs in terms of premature mortality for a fatal MI or stroke.

• Of the 40 economic evaluations identified, only 1 reported indirect costs. The timing of the economic evaluations estimated cost effects from a cohort of patients with T2DM; the remaining four used cost estimates in studies not specific to patients with T2DM.

FUNDING
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REFERENCES
• Please see handout.

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LIMITATIONS AND DATA GAPS
Primary Cost Studies
• None of the identified cost studies reported disaggregated cost components.

Economic Evaluations
• None of the identified cost studies reported indirect costs associated with an MI or stroke in patients with T2DM.

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