Comorbid dementia presents considerable challenges for diabetes (DM) management. This study aims:

1. To examine differences in the quality of diabetes care and the prevalence of DM-related complications in diabetes patients with and without comorbid dementia in Ontario;
2. To study the association between quality of diabetes care and DM-related complications in people with diabetes;
3. To test whether the association between quality of diabetes care and DM-related complications in diabetes patients was modified by presence of dementia.

**DATA SOURCES & STUDY POPULATION**

- Population-based retrospective cohort study.
- Data sources: Administrative & Clinical databases at ICES: Ontario Diabetes Database (OID); Ontario Mental Health Reporting System (OMHRS); Ontario Health Insurance Plan claims database (OHIP); Registered Persons Database (RPDB); Ontario Drug Benefits claims database (ODB); Discharge Abstract Database (CIHI DAD); Client Agency Program Enrolment (CAPE) table.

The study population included:

- All eligible Ontarians with diabetes aged 18 and older alive on April 1, 2007;
- Diagnosed 2 years prior to index date;
- Registered with OHIP.

**MEASURES & ANALYSES**

- Number/proportion of DM-related short-term, including severe hypo- and hyperglycemia, and long-term, including macro- and microvascular complications, in the period 2009-2011.
- Process indicators:
  - HbA1c testing: DM patients who received at least 4 HbA1c tests in the period 2007-2009.
  - LDL-C testing: DM patients who received at least 2 LDL-C tests in the period 2007-2009.
  - Eye exam: DM patients who received at least one dilated eye exam by an eye care professional in the period 2007-2009.
- Composite quality indicator: the presence of all 3 process quality indicators in the period 2007-2009.

**Independent variables:**

- Presence/absence of dementia and other CC (cardiovascular, respiratory, musculoskeletal conditions, depression, renal failure and cancer), age, sex, duration of diabetes, rurality index, income quintile, continuity of care, primary care model.

**Analyses**

- Descriptive analyses - to assess process and outcome indicators for DM with and without dementia.
- Multiple logistic regression analyses separately for individual process indicators and composite measure, as well as for interaction terms.

**RESULTS**

**Table 1: Association between outcome and process measures and dementia among people with diabetes**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>HbA1c (at least 4 tests) OR* (95% CI)</th>
<th>LDL-cholesterol (at least 1 test) OR* (95% CI)</th>
<th>Eye examination OR* (95% CI)</th>
<th>Composite measure OR* (95% CI)</th>
<th>DM short-term complications OR* (95% CI)</th>
<th>DM long-term complications OR* (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DM with dementia</td>
<td>1.09 (1.06, 1.13)</td>
<td>0.51 (0.50, 0.53)</td>
<td>0.44 (0.41, 0.46)</td>
<td>0.47 (0.46, 0.49)</td>
<td>1.45 (1.39, 1.52)</td>
<td>1.43 (1.23, 1.64)</td>
</tr>
</tbody>
</table>

*OR: odds ratio; CI: confidence interval.

**Table 2: Association between composite measure and DM long-term complications, and modifying effect of dementia**

<table>
<thead>
<tr>
<th>Model</th>
<th>Parameter</th>
<th>DM long-term complications OR* (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1</td>
<td>No composite measure</td>
<td>Ref.</td>
</tr>
<tr>
<td></td>
<td>Composite measure</td>
<td>0.75 (0.69, 0.83)</td>
</tr>
<tr>
<td>Model 2</td>
<td>DM without dementia without composite measure</td>
<td>0.81 (0.75, 0.89)</td>
</tr>
<tr>
<td></td>
<td>DM without dementia without composite measure</td>
<td>1.12 (1.07, 1.15)</td>
</tr>
<tr>
<td></td>
<td>DM with dementia with composite measure</td>
<td>1.24 (0.91, 1.66)</td>
</tr>
</tbody>
</table>

*OR: odds ratio; CI: confidence interval.

**Table 3: Association between HbA1c tests and DM short-term complications, and modifying effect of dementia**

<table>
<thead>
<tr>
<th>Model</th>
<th>Parameter</th>
<th>DM short-term complications OR* (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1</td>
<td>HbA1c tests (&lt;4 test)</td>
<td>Ref.</td>
</tr>
<tr>
<td></td>
<td>HbA1c test (≥4 tests)</td>
<td>1.12 (1.10, 1.16)</td>
</tr>
<tr>
<td>Model 2</td>
<td>DM without dementia +HbA1c ≤4</td>
<td>1.12</td>
</tr>
<tr>
<td></td>
<td>DM without dementia +HbA1c &gt;4</td>
<td>1.47 (1.38, 1.56)</td>
</tr>
<tr>
<td></td>
<td>DM with dementia +HbA1c ≤4</td>
<td>1.29 (1.23, 1.38)</td>
</tr>
<tr>
<td></td>
<td>DM with dementia +HbA1c &gt;4</td>
<td>1.16 (0.89, 1.61)</td>
</tr>
</tbody>
</table>

*OR: odds ratio; CI: confidence interval.

**ACKNOWLEDGMENTS**

This research was supported by a research grant from the Ontario Ministry of Health and Long Term Care (MOHLTC) to the Health System Performance Research Network (HSPRN). The opinions, results and conclusions reported in this paper are those of the authors and are independent from the funding sources. No endorsement by the MOHLTC is intended or should be inferred.

**REFERENCES**

- **Figure 1:** Receipt of DM monitoring tests in DM patients with and without dementia.
- **Figure 2:** DM-related complications in DM patients with and without dementia.

**KEY FINDINGS**

- Cohort size: 861,354; 37,739 (4.4%) diabetes patients had comorbid dementia diagnosis.
- Overall, quality of diabetes care in Ontario was low (target being 80% and above).
- 36.2% for HbA1c testing; 58.2% for LDL-C testing; 65.5% for eye exam; 25.9% for composite measure.
- Differences in quality of diabetes care and risk of DM-related complications according to dementia status were statistically significant.
- Diabetes patients with comorbid dementia were significantly more likely to receive HbA1c tests and less likely to receive LDL-C tests and eye examination.
- Diabetes patients with comorbid dementia were significantly more likely to experience DM-related short-term and long-term complications.
- There was a protective association between good quality of DM care and risk of DM-related long-term complications among participants.
- DM patients who received DM monitoring tests were significantly less likely to develop DM-related long-term complications, compared to those who did not.
- Diabetes patients had a higher risk of DM-related short-term complications even in the presence of good quality of DM care.
- DM patients who received optimal number of HbA1c tests showed significantly higher risk of DM-related short-term complications, compared to those who did not.