Self-monitoring blood glucose

Non-insulin-treated type 2 diabetes in Australian general practice

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Clare Bayram
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Background
Benefits of self-monitoring blood glucose (SMBG) in non-insulin-treated type 2 diabetes (T2D) are questionable. We investigated proportions of general practitioner (GP) patients who self-monitor, and associations between SMBG, glycosylated haemoglobin (HbA1c) and body mass index (BMI).

Methods
Sub-studies of the Bettering the Evaluation and Care of Health (BEACH) program, involving 5 730 patients from 194 GPs. Outcomes Type 2 diabetes prevalence; HbA1c; BMI; blood glucose (BG) monitoring routine.

Results
Prevalence of non-insulin-treated T2D was 6.7%. Mean HbA1c level was 7.1%. Almost half (47.5%) of T2D patients were obese compared with 26.7% of patients at all BEACH encounters in 2011–2012. Of 344 non-insulin-treated T2D patients, 79.4% self-monitored fasting BG and 69.7% of 314 self-monitored post-prandial BG. For both groups, mean HbA1c was significantly higher for those who tested daily than for those who never tested.

Conclusion
Patients with non-insulin-treated T2D who test BG daily may be those struggling for control. For others, benefits seem minimal for the proportion utilising self-monitoring.

Keywords
diabetes mellitus, type 2; blood glucose self-monitoring
Self-monitoring blood glucose – non-insulin-treated type 2 diabetes in Australian general practice

Results

Recording pads with completed SMBG questions, and 30 patients from each sample of 100 were surveyed over a 10-week period from 7th June to 15th August 2011.

GPs were asked to record for the patient: whether they had diagnosed T2D; their most recent HbA1c result; their current height and weight (for calculation of BMI); how often they measure fasting and/or post-prandial BG; and medications currently taken for management of BG levels.

We calculated proportions and robust 95% confidence intervals (CI) using survey procedures in SAS (version 9.2) that adjust for the study’s cluster design. Statistical significance of differences was judged by non-overlapping 95% CIs, which improve the interpretation of data because they provide robust upper and lower boundaries for the probable size of the true effect. Calculated BMI scores were compared for patients who self-monitor daily, self-monitor weekly or less, and never self-monitor. BMI scores of patients with T2D were also compared with those of all patients whose BMI was recorded at BEACH encounters in 2011–2012. Missing data were removed from the analyses.

An unadjusted prevalence estimate was calculated as the number of patients with T2D as a proportion of the total sample of respondents. This estimate can be interpreted as the prevalence of T2D among patients who present to GPs at any given time.

Table 1. Patients with non-insulin-treated type 2 diabetes – self-monitoring blood glucose behaviour and HbA1c

<table>
<thead>
<tr>
<th>Patients</th>
<th>Mean HbA1c</th>
<th>% (95% CI)</th>
<th>mmol/mol (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All patients with non-insulin-treated T2 diabetes</td>
<td>385</td>
<td>100.0</td>
<td>7.1 (7.0–7.2)</td>
</tr>
<tr>
<td>Patients who self-monitor BG (ever) (missing = 36)</td>
<td>278</td>
<td>79.7</td>
<td>7.1 (7.0–7.3)</td>
</tr>
<tr>
<td>Patients who self-monitor both fasting &amp; post-prandial BG at least occasionally (missing = 36)</td>
<td>214</td>
<td>61.3</td>
<td>7.1 (7.0–7.3)</td>
</tr>
<tr>
<td>Patients who self-monitor either fasting or post-prandial BG at least occasionally (missing = 36)</td>
<td>64</td>
<td>18.3</td>
<td>7.1 (7.0–7.3)</td>
</tr>
<tr>
<td>Patients who never self-monitor BG (missing = 36)</td>
<td>71</td>
<td>20.3</td>
<td>6.7 (6.5–7.0)</td>
</tr>
</tbody>
</table>

* Missing data removed so denominator = 349

Figure 1: Age distribution of patients at GP-patient encounters – this SAND sub-study vs all GP consultation items claimed through Medicare in 2011–12

Figure 1: Age distribution of patients at GP-patient encounters – this SAND sub-study vs all GP consultation items claimed through Medicare in 2011–12
Discussion

Four out of five general practice patients with non-insulin-treated T2D self-monitored BG either daily or occasionally. Two-thirds self-monitored fasting BG and half self-monitored post-prandial BG, at least weekly. The mean patient HbA1c level was 7.1% (54.1 mmol/mol), and was significantly higher for those who self-monitored daily than for those who never self-tested. These results show that while SMBG is common among patients with non-insulin-treated T2D, no beneficial clinical outcome is discernible in terms of HbA1c levels.

The BMI levels were not different for patients who self-monitored compared with those who did not, and collectively the proportion of obese patients was nearly double that of all patients attending general practice. The IDF suggestion that self-monitoring may induce lifestyle changes and weight reduction is not supported by these findings; neither did we find evidence that clinicians are encouraging overweight/obese T2D patients to self-monitor their BG.

Results should be considered in light of the study’s limitations. Prevalence estimates are waiting-room estimates, not population estimates. Older patients with multiple morbidity are likely to attend more frequently and therefore more likely to be sampled in BEACH. The effect of self-monitoring over time could not be measured with cross-sectional point estimates – patients may have had better (or worse) HbA1c levels previously or may have been influenced by interventions other than self-monitoring. Time since diagnosis was not asked – it is possible that patients who self-monitor daily had significantly

Table 2. Patients with non-insulin-treated type 2 diabetes – self-monitoring of fasting and post-prandial blood glucose

<table>
<thead>
<tr>
<th>% of patients with T2D* (n = 385)</th>
<th>% of patients who self-monitor* (n = 278)</th>
<th>Mean HbA1c % (95% CI)</th>
<th>mmol/mol (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fasting BG measurement</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(missing = 41)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Daily</td>
<td>106</td>
<td>30.8</td>
<td>7.4 (7.1–7.7)</td>
</tr>
<tr>
<td>Weekly</td>
<td>104</td>
<td>30.2</td>
<td>6.9 (6.7–7.1)</td>
</tr>
<tr>
<td>&lt;1 per week</td>
<td>63</td>
<td>18.3</td>
<td>7.1 (6.8–7.4)</td>
</tr>
<tr>
<td>Total who self-monitor fasting BG</td>
<td>273</td>
<td>79.4</td>
<td>7.2 (7.0–7.3)</td>
</tr>
<tr>
<td>Never test fasting BG</td>
<td>71</td>
<td>20.6</td>
<td>6.7 (6.5–7.0)</td>
</tr>
<tr>
<td><strong>Post-prandial BG measurement</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(missing = 71)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Daily</td>
<td>60</td>
<td>19.1</td>
<td>7.5 (7.2–7.8)</td>
</tr>
<tr>
<td>Weekly</td>
<td>91</td>
<td>29.0</td>
<td>6.9 (6.7–7.2)</td>
</tr>
<tr>
<td>&lt;1 per week</td>
<td>68</td>
<td>21.7</td>
<td>7.2 (6.9–7.5)</td>
</tr>
<tr>
<td>Total who self-monitor post-prandial BG</td>
<td>219</td>
<td>69.7</td>
<td>7.2 (7.0–7.3)</td>
</tr>
<tr>
<td>Never test post-prandial BG</td>
<td>95</td>
<td>30.3</td>
<td>6.8 (6.5–7.0)</td>
</tr>
</tbody>
</table>

* missing data removed

Table 3. Body mass index – adult patients at BEACH encounters in 2010–11, and of patients with non-insulin treated type 2 diabetes by self-monitoring status

<table>
<thead>
<tr>
<th>BEACH sample 2010-11 % (95% CI)</th>
<th>Non-insulin treated T2 diabetes patients % (95% CI)</th>
<th>Patients who self-monitor daily % (95% CI)</th>
<th>Patients who self-monitor weekly or less % (95% CI)</th>
<th>Patients who never self-monitor % (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obese</td>
<td>26.7 (26.0–27.5)</td>
<td>47.5 (41.7–53.3)</td>
<td>46.8 (36.7–57.0)</td>
<td>51.6 (43.9–59.4)</td>
</tr>
<tr>
<td>Overweight</td>
<td>35.1 (34.4–35.7)</td>
<td>34.1 (28.9–39.4)</td>
<td>35.1 (25.6–44.6)</td>
<td>30.3 (23.2–37.5)</td>
</tr>
<tr>
<td>Normal</td>
<td>35.8 (35.0–36.7)</td>
<td>18.1 (13.8–22.3)</td>
<td>18.0 (10.8–25.2)</td>
<td>18.1 (12.2–23.9)</td>
</tr>
<tr>
<td>Underweight</td>
<td>2.4 (2.2–2.6)</td>
<td>0.3 (0.0–0.9)</td>
<td>0.0</td>
<td>1.5 (0.0–4.4)</td>
</tr>
</tbody>
</table>

* BMI missing = 51, † BMI missing = 4, ‡ BMI missing = 8, ‡ BMI missing = 3
higher HbA1c levels than patients who never test, because they are newly diagnosed and not yet controlled. They may also include patients with more severe diabetes who struggle for control. However, the numbers who self-monitor far exceed the proportion who would have been recently diagnosed. In a previous sub-study, only 5.6% of T2D patients had been diagnosed in the previous year, and over 80% more than five years previously.19

The 79% who reported SMBG is consistent with another finding, that 83.7% of patients with T2D had their own monitoring device. For 44.7% of these patients, the device had been recommended by their GP, and for 35.3%, by a diabetes educator. Smaller proportions reported the devices being recommended by an endocrinologist (6.7%), or pharmacist (7.3%).20

Such recommendations encourage patients with non-insulin-treated T2D to self-monitor, despite the lack of evidence supporting clinical benefits or cost-effectiveness, and regardless of reported negative outcomes. Guidelines are ambiguous, advising clinicians that while there is no conclusive evidence of benefit, the current leaning is to recommend SMBG as there may be some benefit to some patients in some circumstances, with appropriate training and education.3,4,23

Implications for general practice

While the cross-sectional data have less strength than interventional data, these results concur with findings from the published randomised controlled trials (RCTs) reviewed for this work, and with the growing body of evidence that the practice of SMBG is of little benefit to most patients with non-insulin-treated T2D. They further inform the DUSC/PBAC review on the utilisation and patterns of SMBG, and the proportion of patients with T2D who may be affected by the outcome of the review.13

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Competing interests: See Acknowledgements below.

Ethics approval: The BEACH program and SAND sub-studies are approved by the Human Research Ethics Committee of the University of Sydney (Ethics protocol Ref. No. 11428). Provenance and peer review: Not commissioned; externally peer reviewed.

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Each funding organisation has the right to nominate two topics for the BEACH/SAND sub-studies. The organisation works with the BEACH team to formulate the research questions for the SAND questionnaire. The final decision on the acceptability of the research questions rests with the BEACH team. All SAND questions are subject to approval by the Human Research Ethics Committee of the University. Once the SAND questions are approved, the processes of data collection, analysis and reporting are conducted exclusively by the BEACH research team, including the development of published abstracts of the research.

Any peer-reviewed papers developed from SAND sub-studies are authored or co-authored by the BEACH research team. The funding organisation supporting the study has no editorial control over any aspect of the paper including the presentation of results. No financial support for production of the paper is accepted from the funding organisations.

References


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