Severe Hypoglycemia in Diabetes (Types 1 and 2) Risk Factors: Second Diabetes Attitudes, Wishes and Needs (DAWN2) Study

Background

The DAWN2 study is a validated multinational survey system for assessing and benchmarking psychosocial and educational aspects of diabetes care delivery through:

- a better understanding of unmet needs of people with diabetes and those who care for them
- improved dialog and collaboration among all key stakeholders to strengthen active patient involvement and self-management

Severe hypoglycemia (SH) is still the limiting factor and a potential risk factor for morbidity and mortality in people with T1DM and pharmacologically-treated T2DM. The knowledge about potential risk factors of SH is important to identify people at risk for SH and to target modifiable risk factors for the prevention of SH.

Aims

The aim of this sub-study nested in the DAWN2 study is to analyze the demographic (age, diabetes duration), medical (hypoglycemia awareness, treatment factors, incidence of symptomatic hypoglycemia) and psychosocial (diabetes distress and well-being) correlates of SH in people with T1DM and pharmacologically-treated T2DM (people on oral antidiabetic agents or insulin treatment).

Methods

In each of 17 countries, 500 adults with T1DM or T2DM answered questions about SH (requiring assistance of a third party for recovery) during the last year. In this sub-study, data of participants were analyzed who had either T1DM or T2DM, treated with an oral antidiabetic drug regimen or insulin therapy. Hypoglycemia awareness was assessed by asking participants how often they detected low blood glucose by symptoms alone (answer ranged from “never” to “always”). Participants also reported the frequency of symptomatic hypoglycemia episodes recognized by symptoms and self-treated.

The number of insulin injections was assessed as an indicator of treatment intensity. The number of daily SMBG readings were also reported. Participants also completed the WH-5 well-being scale and PAD-5.

Correlates and risk factors of hypoglycemia were analyzed by univariate as well as multivariate Poisson regression models weighted for country differences in T1DM and T2DM separately.

Results

Participants were 1368 adults with T1DM and 5485 with T2DM on pharmacological treatment. The sample characteristics are shown in Table 1.

- One fifth of the people with T1DM were treated with only one injection of insulin Whilst half were managed on two or more than two insulin injections.
- Substantially more people with T1DM reported at least one episode of SH during the last year.
- A high prevalence of complications was reported in people with T1DM and T2DM.
- SMBG was markedly more frequent in people with T1DM than T2DM.
- People with T1DM reported higher diabetes-related distress and lower well-being than with T2DM.

Table 1. Participant characteristics.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>T1DM</th>
<th>T2DM</th>
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<tbody>
<tr>
<td>Median age, years (IQR)</td>
<td>41 (31–52)</td>
<td>61 (53–68)</td>
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<tr>
<td>Male, %</td>
<td>52.4</td>
<td>47.5</td>
</tr>
<tr>
<td>Participants with complications, %</td>
<td>71.3</td>
<td>74.8</td>
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<tr>
<td>Participants with SH, %</td>
<td>54.0</td>
<td>34.8</td>
</tr>
<tr>
<td>Number of days with SMBG per month (median)</td>
<td>6 (3–7)</td>
<td>4 (1–7)</td>
</tr>
<tr>
<td>SH awareness, %</td>
<td>15.5</td>
<td>26.7</td>
</tr>
<tr>
<td>Number of insulin injections</td>
<td>2.8</td>
<td>1.5</td>
</tr>
</tbody>
</table>

In Figure 1, the incidence of SH is depicted in people with T1DM and T2DM according to the number of insulin injections. With an increasing number of insulin injections, the incidence of SH is increased significantly in people with T1DM and T2DM. However, in adults with T1DM and T2DM, the reported incidence of SH was highest if two insulin injections were given. The incidence of SH was lower in participants who had one or multiple daily injections.

Figure 1. Incidence of SH according to number of insulin injections in people with T1DM and pharmacologically-treated T2DM.

Figure 2. Incidence of symptomatic hypoglycemia in people with T1DM and pharmacologically-treated T2DM.

Figure 3. Proportion of SH in people with T1DM and pharmacologically-treated T2DM.

Figure 4. Proportion of people with elevated diabetes-related distress and low well-being in those with and without SH.

Conclusions

- Risk factors for SH differed in people with T1DM and T2DM. The frequency of SMBG was associated with the risk of SH differently for T1DM and T2DM. Hypoglycemia unawareness appeared as a potent risk factor in people with T1DM, whereas in T2DM, the frequency of SH reported for people with SH was strongly associated with higher risk of SH. The different risk of hypoglycemia awareness for the risk of SH should be further explored in both diabetes types.
- A very long diabetes duration (>15 years) was a more important risk factor in T1DM than T2DM.
- Modifiable risk factors in both diabetes types were a high number of symptomatic hypoglycemic episodes and the number of insulin injections. Interestingly, in T1DM, a more intense insulin regimen (≥2 injections) was associated with a lower risk of SH than insulin regimen with one or two injections. This may suggest the less physiologic insulin replacement, which is based on an insulin pump or two insulin injections only, is associated with an increased risk of SH in people with T1DM. In T2DM, the addition of one insulin injection did not increase the risk of SH, whereas regimens with two insulin injections were associated with a higher risk of SH.
- Elevated diabetes distress and low well-being is clearly associated with higher risk of SH. This suggests the people reporting high diabetes distress or low well-being, potential diabetes-related causes, like the occurrence of SH, should be considered.
- Limitations of this study should be considered while interpreting these results. Potential limitations of this study are the cross-sectional nature of this study; the use of self-report data; and the use of self-report data as the main data source.

References

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Abbreviations

SH—Severe Hypoglycemia; T1DM—Type 1 Diabetes Mellitus; T2DM—Type 2 Diabetes Mellitus; BMI—Body Mass Index; IQR—Interquartile Range; OR—Odds Ratio; CI—Confidence Interval; COX—Cox’s Proportional Hazards Model; PAD-5—Patient Assessment of Diabetes-5; WH-5—Well-Being Scale; SMBG—Self-Monitoring of Blood Glucose; WHO—World Health Organization; IDF—International Diabetes Federation; IPPC—International Publication Planning Committee.

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Figure 5. Multivariate Poisson regression model weighted for country differences of correlates with SH in people with T1DM.

The multivariate model for T2DM (Figure 6) showed:

- an increased risk of SH in people with a diabetes duration longer than 4 years
- more frequent SMBG was associated with a lower risk of SH
- there was no gender effect
- SH risk was significantly more pronounced in younger people with T2DM
- interestingly, SH was more frequent in people with T2DM who reported that they recognized low blood glucose by symptoms
- an insulin regimen based on two insulin injections was associated with a higher risk of SH
- fewer episodes of mild symptomatic hypoglycemia than once per week reduced the relative risk of SH markedly in people with T2DM reporting SH in the previous year had significantly higher diabetes distress and lower well-being than those with SH.

Figure 6. Multivariate Poisson regression model weighted for country differences of correlates with SH in people with T2DM.