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# Severe hypoglycaemia and its association with psychological well-being in Australian adults with type 1 diabetes attending specialist tertiary clinics

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## ABSTRACT

**Aim:** To investigate severe hypoglycaemia (SH) in adults with type 1 diabetes and its associations with impaired awareness of hypoglycaemia (IAH), clinical, psychological and socio-demographic factors.

**Methods:** Attendees of three specialist diabetes clinics in Melbourne, Australia completed questions about frequency of SH in the past six months; impaired awareness of hypoglycaemia (Gold score); and measures of general emotional well-being (WHO-5), diabetes-specific positive well-being (subscale of W-BQ28), diabetes-related distress (PAID) and fear of hypoglycaemia (HFS).

**Results:** Of 422 participants (mean  $\pm$  SD age 37.5  $\pm$  15.0 years; 54% women), 78 (18.5%) reported at least one SH event and 86 (20.5%) had IAH. SH and IAH frequencies were similar at all clinics. In total, 194 SH events were reported, with 10 people experiencing 40% of events. Compared with those without SH, participants with SH had longer diabetes duration, were younger at diabetes onset and more likely to have IAH ( $p < 0.01$ ). Those with SH had greater fear of hypoglycaemia and diabetes-related distress, poorer general emotional well-being, and lower diabetes-specific positive well-being, ( $p < 0.01$ ). There were no associations with age, gender, insulin regimen or HbA1c.

**Conclusions:** This study has identified that SH and IAH in Australian adults with type 1 diabetes exist at similar levels to those reported in US and European research. SH was significantly associated with IAH and fear of hypoglycaemia.

Assessment of hypoglycaemia, IAH and psychological well-being as part of a routine diabetes clinic visit was well accepted by attendees and enabled identification of those who may benefit from medical, educational or therapeutic interventions.

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**Abbreviations:** CSII, continuous subcutaneous insulin infusion; HbA1c, haemoglobin A1c; HFS, Hypoglycaemia Fear Survey; HypoA-Q, Hypoglycaemia Awareness Questionnaire; IAH, impaired awareness of hypoglycaemia; PAID, Problem Areas In Diabetes; SH, severe hypoglycaemia.

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## 1. Introduction

Severe hypoglycaemia (SH), requiring external assistance for recovery, is a common, feared and challenging complication of type 1 diabetes. It can result in collapse without warning, seizures, coma or death. Recurrent SH poses a significant challenge in terms of risk to personal safety, loss of personal control and independence, quality of life and mood changes [1]. Over time the awareness of hypoglycaemic symptoms diminishes which increases the annual risk of SH sixfold [2]. In unselected populations, between 30% and 40% of adults with type 1 diabetes have at least one SH event per year [2–4] depending on the definition and method of assessment of SH, and duration of diabetes. In a large Australian survey conducted in 2011, 20% of adults with type 1 diabetes reported having had at least one SH event in the past six months [5]. Adults who have diabetes for >15 years experienced higher rates of SH than those with diabetes for <5 years (22% versus 46%) [6].

Over the past decade, a significant decrease has been observed in the rates of SH in an Australian cohort of children and adolescents with type 1 diabetes [7], which may relate to the greater use of continuous subcutaneous insulin infusion (CSII) and modern insulins. Such data are unavailable for Australian adults. Internationally, studies conducted during the past decade have shown no change in the frequency of hypoglycaemia in adults with diabetes [2]. Today, as it was a decade ago, SH and fear thereof, remains the greatest barrier to achieving optimum glycaemic control [8].

The unpleasant symptoms and consequences of hypoglycaemic episodes can lead to fear of hypoglycaemia and impaired quality of life, for the person with diabetes [9,10] as well as for their relatives [11]. A consistent association has been reported between fear of hypoglycaemia and the frequency of (severe) hypoglycaemic events [10,12]. Experiencing one SH event has been shown to have an immediate negative impact on mood (increased fear of hypoglycaemia) and behaviour (reduction of insulin dose), which complicates improvement of clinical outcomes [10,13]. Despite these findings, fear of hypoglycaemia frequently remains unrecognised [2].

The frequency of SH and impaired awareness of hypoglycaemia (IAH) in unselected clinic samples of adults with type 1 diabetes in Australia is unknown, nor has the psychological impact of SH been studied. Therefore, our aim was to examine self-reported prevalence of hypoglycaemia in a population of Australian adults with type 1 diabetes attending one of three specialist diabetes clinics; and to explore its associations with IAH, clinical, psychological and socio-demographic factors [14].

## 2. Methods

### 2.1. Setting and participants

Participants were recruited from three metropolitan specialist clinics: Royal Melbourne Hospital (site 1), St Vincent's Public Hospital (site 2), Baker IDI Heart and Diabetes Institute (site 3). In general, adults with type 1 diabetes attend these clinics on a quarterly basis, so data were collected over 8 to 12 weeks to capture people attending for routine appointments and to

minimise risk of duplication. Data collections took place between October and December 2011 (site 1), and between February and May 2012 (sites 2 and 3). In accordance with national standards, the study was approved by Deakin University Human Research Ethics, Melbourne Health Human Research Ethics Committee, The Alfred Hospital Ethics Committee, and the Human Research Ethics Committee of St Vincent's Hospital.

### 2.2. Procedure

Upon arrival in the clinic, all patients with type 1 diabetes were invited to participate in the study by a research assistant and/or diabetes nurse educator or endocrinologist (sites 1 and 2), clinical researcher and/or endocrinologist (site 3), who provided attendees with written information and answered questions about the study. Patients were eligible if they were aged  $\geq 18$  years, had been diagnosed with type 1 diabetes for more than six months and were able to complete the survey in English without assistance. Those who attended the clinic more than once during the period were avoided on their subsequent visit based on their unique clinic number. After giving written consent, most participants completed their questionnaire booklets in the waiting room, some preferred completion at home and returned the booklet by mail or at the next visit. The booklet included seven pages of questions; four pages focused on hypoglycaemia (recall of events, impaired awareness and fear of hypoglycaemia) with the remaining pages focused on psychological well-being and demographic/clinical questions. Questionnaire completion took 15 to 20 minutes.

### 2.3. Assessment of hypoglycaemia

#### 2.3.1. Self-reported severe hypoglycaemic episodes

Items were derived from the Hypoglycaemia Awareness Questionnaire (HypoA-Q), a measure developed for the Hypo COMPASS trial [15]. Survey questions asked about frequency of SH, defined as “when you needed help/were unable to treat yourself”, and healthcare resource utilisation for each event (“emergency services were called in”, “taken to the hospital”, “stayed overnight in the hospital”). Participants were asked to write how many times each event had taken place in the past six months.

#### 2.3.2. Impaired awareness of hypoglycaemia (IAH)

IAH was assessed using the Gold score [16], a single item (“Do you know when your hypos are commencing?”) scored on a 7-point scale where a score of  $\geq 4$  indicates impaired awareness. In addition, three items were included from the HypoA-Q: “I have symptoms when my blood glucose is low”, “Other people recognise I am hypo before I do”, “I check my blood glucose level if I ‘feel’ low”. Response options range from never (score 1) to always (score 5).

### 2.4. Psychological measures

#### 2.4.1. General emotional well-being

The WHO-5 well-being index (WHO-5) consists of five positively-worded items about “how you have been feeling

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