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# Managing Problematic Hypoglycaemia

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Control

Hypoglycaemia



# International Hypoglycaemia Study Group (IHSG) classification of hypoglycemia

## **Alert value**

Plasma glucose  
< 3.9 mmol/L  
(70 mg/dL) and  
no symptoms

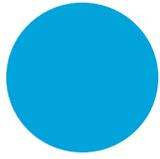
## **Non-severe vs. severe symptomatic:**

- Non-severe: Patient has symptoms but can self-treat and cognitive function is mildly impaired
- Severe: Patient has symptoms and cognitive function markedly impaired

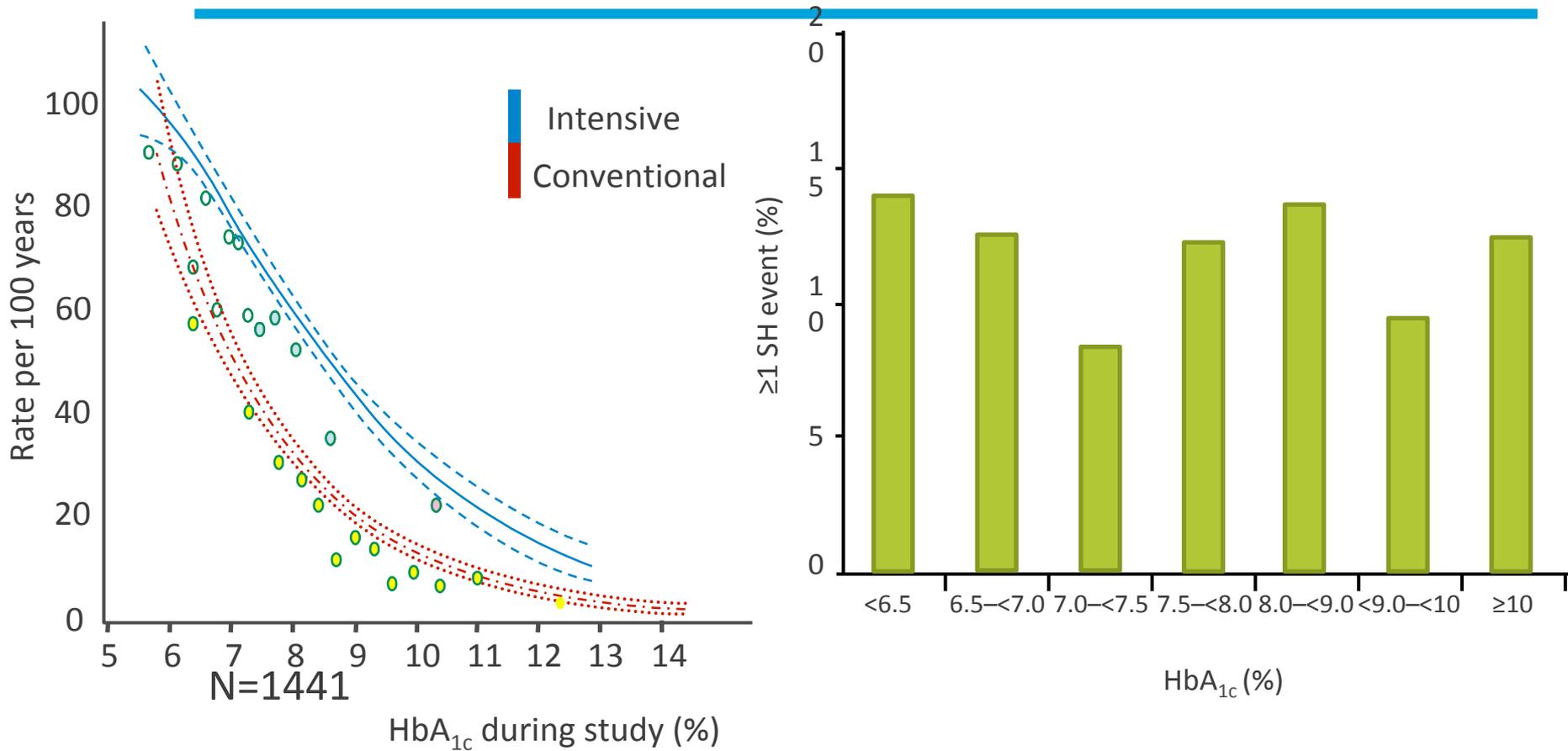
## **Serious biochemical**

Plasma glucose  
< 3.0 mmol/L  
(54 mg/dL)



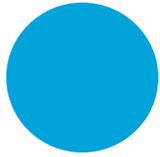


# Is tighter control associated with more severe hypoglycaemia?



HbA<sub>1c</sub>, glycated haemoglobin; SH, severe hypoglycaemia

DCCT Research Study Group. *Diabetes* 1997 46:271–86; Weinstock *et al. J Clin Endocrinol Metab* 2013;98:3411–19; Choudhary *et al. Diabet Med* 2010;27:666–7



# Assessing hypoglycemia awareness

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How well can you detect onset of hypoglycemia

Always 1      2      3      4      5      6      7      Never

[ Gold score ]

When do you usually detect your hypos

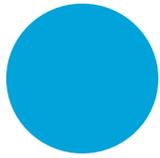
Above 3.0 mmol/l

Below 3.0 mmol.l

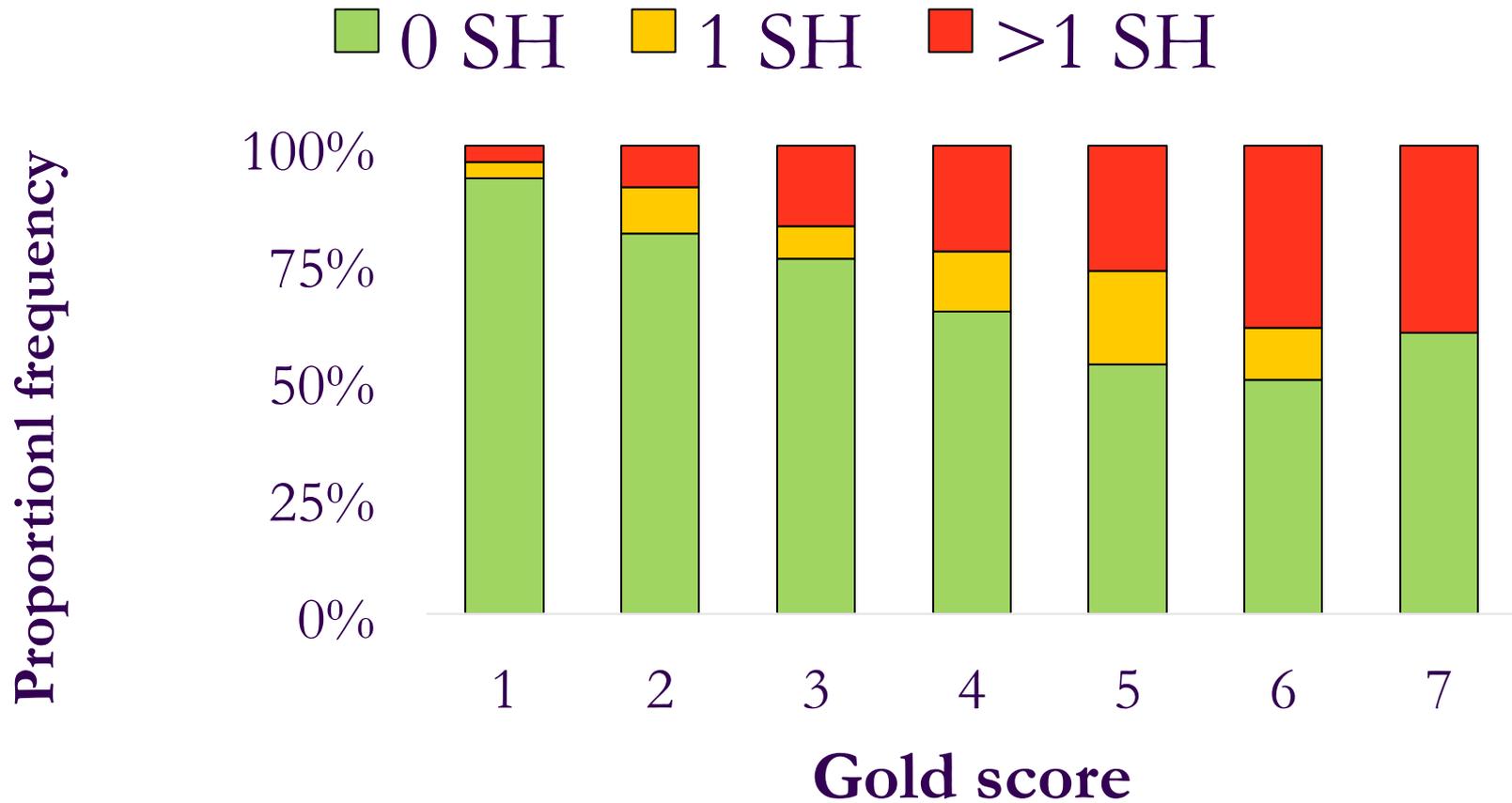
Never

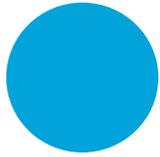
[ DAFNE UK ]

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# Severe hypoglycaemia (SH) episodes in the past year, per Gold score





## Is this a severe hypo

27 year old IT banker

Out at a party

Came home - incoherent, stumbling

Flatmate called ambulance as she was worried

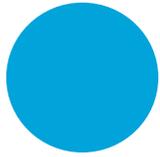
Pt eventually drank some juice and recovered

Paramedics checked glucose and went home

Yes

No





# SH increases with duration of diabetes

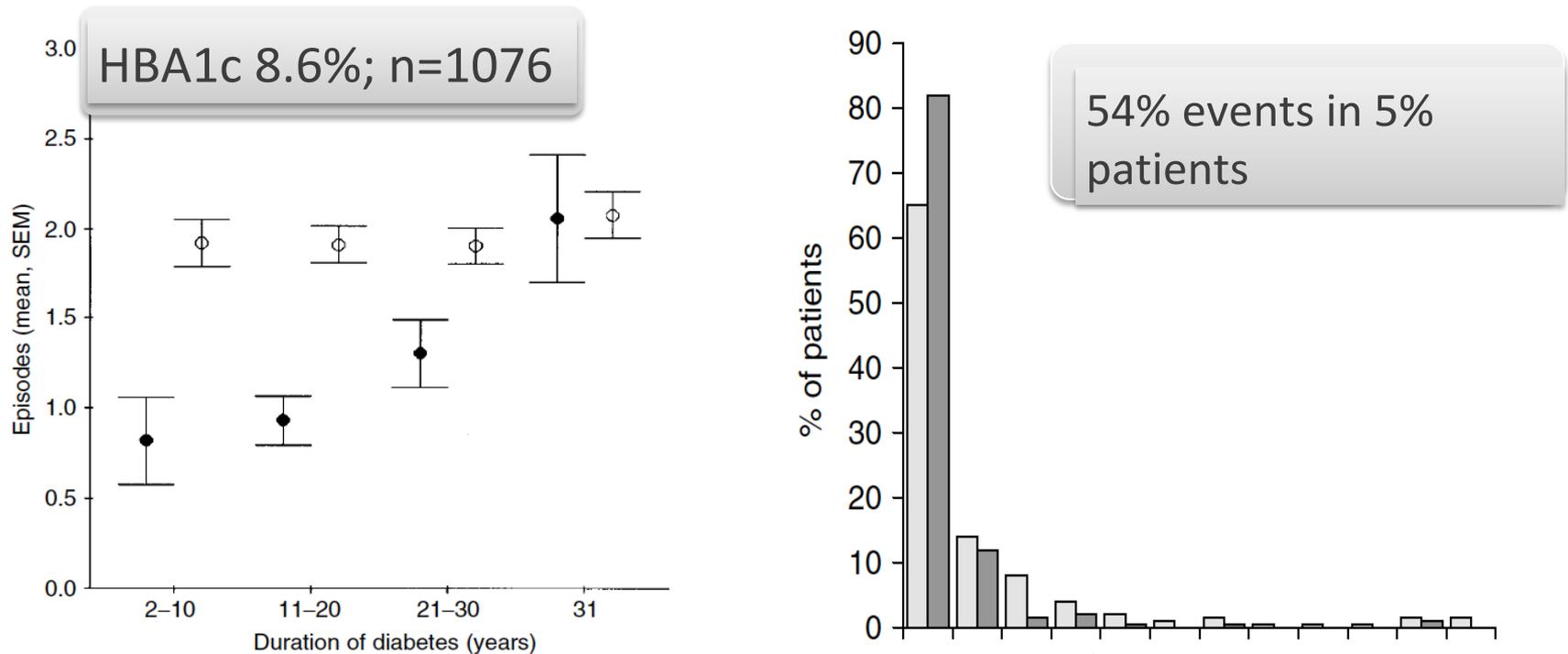
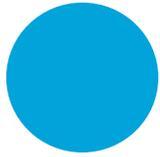


Figure 3. Relationship between duration of diabetes and rates of severe (closed circles: episodes per year) and mild hypoglycaemia (open circles: episodes per week) in subjects with type 1 diabetes



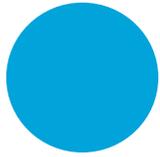
## Clinical scenario

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- New referral
- 36 year female with T1 DM since childhood
- Always had good control with HbA1c < 7% usually
- Insulin lispro 10 units TDS + Insulin glargine 10 units Nocte
- Problematic hypos – please review

What's your plan?

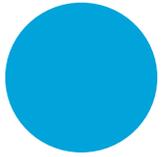
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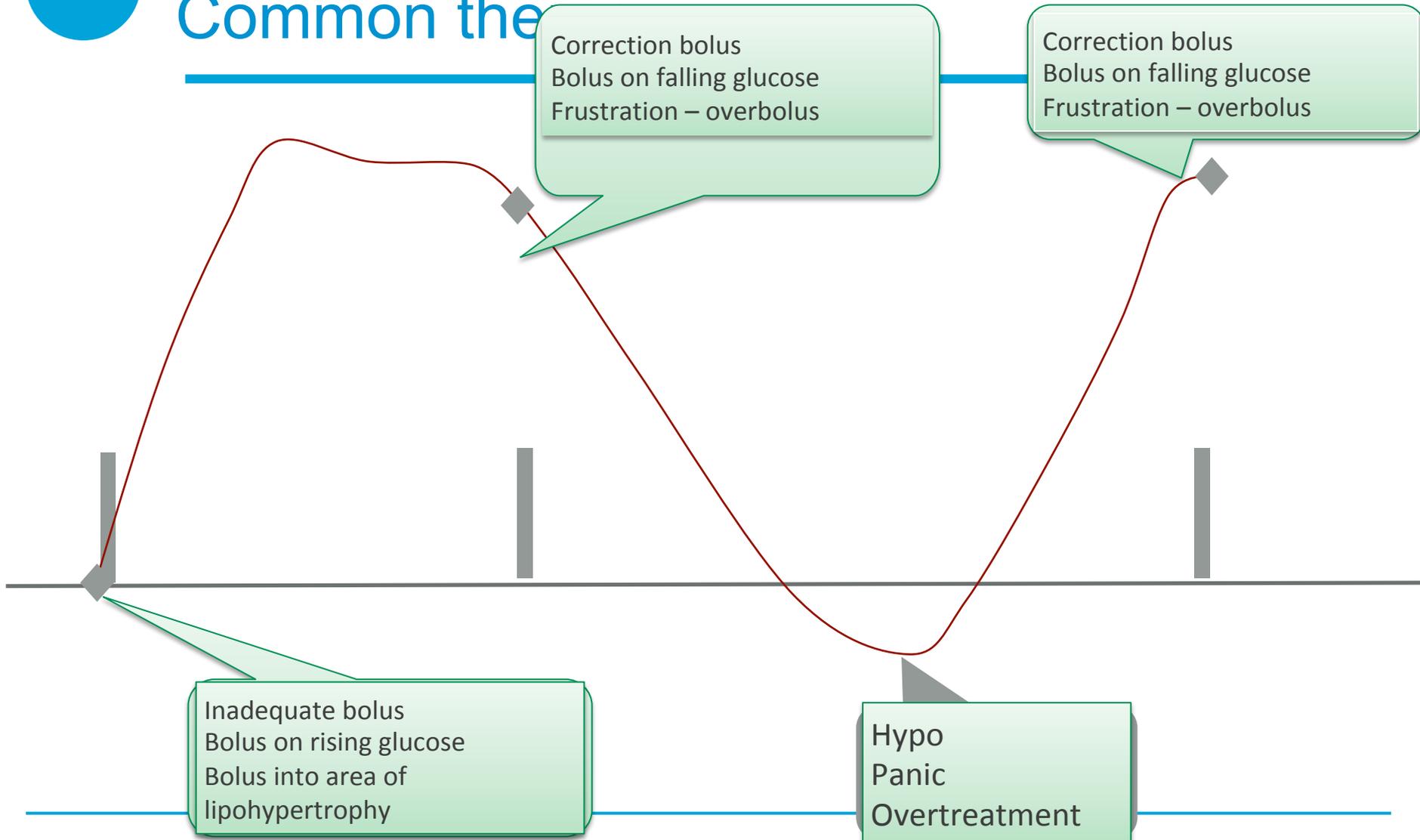
## Further history

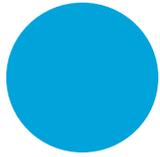
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- Seen every 3/12 - told very good control
  - 1st SH 10 yrs ago. Reduced awareness since then
  - 1-2 SH / year + many episodes when work colleagues or family have caught a hypo before she lost consciousness.
  - 10 x SH in past year requiring paramedic intervention
  - Current treatment
  - Insulin lispro 10 units TDS
  - Insulin glargine 10 units nocte.
-



# Common the

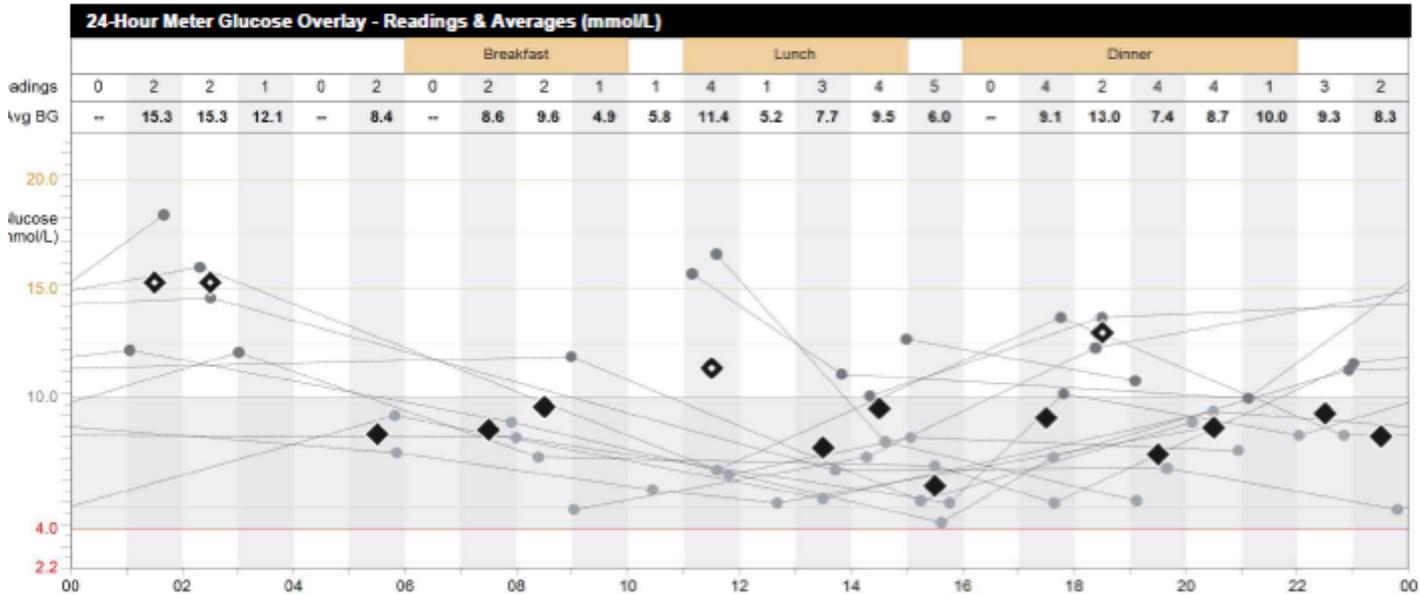
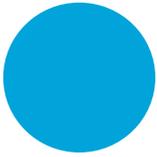




# What should be our plan?

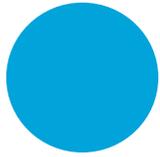
- **Plan:**

- Exclude biochemical cause [ cortisol, GH . Coeliac / Tft /renal and liver fn
- Check sites / insulin Ab
- Education / alcohol / exercise / CHO
- In clinic that day
- Bolus advisor meter
- Re-balance the insulin with some simple fixed dose advice
- URGENT DAFNE [ education program
- 3 months – Gold 5; no further SH; still having a lot of hypos-→ progress to CSII



Statistics	02/07 - 15/07	
Avg BG (mmol/L)	9.2	± 3.5
BG Readings	50	3.6/day
Readings Above Target	18	36%
Readings Below Target	--	0%
Sensor Avg (mmol/L)	--	
Avg AUC > 10.0 (mmol/L)	--	
Avg AUC < 4.0 (mmol/L)	--	
<hr/>		
Avg Daily Carbs (g)	192	± 48
Carbs/Bolus Insulin (g/U)	11.9	
<hr/>		
Avg Total Daily Insulin (U)	27.8	± 3.5
Avg Daily Basal (U)	11.5	42%
Avg Daily Bolus (U)	16.1	58%

- 4 years later
- No SH since referral
- Now has awareness at 3.0 mmol/l
- Restored Driving licence



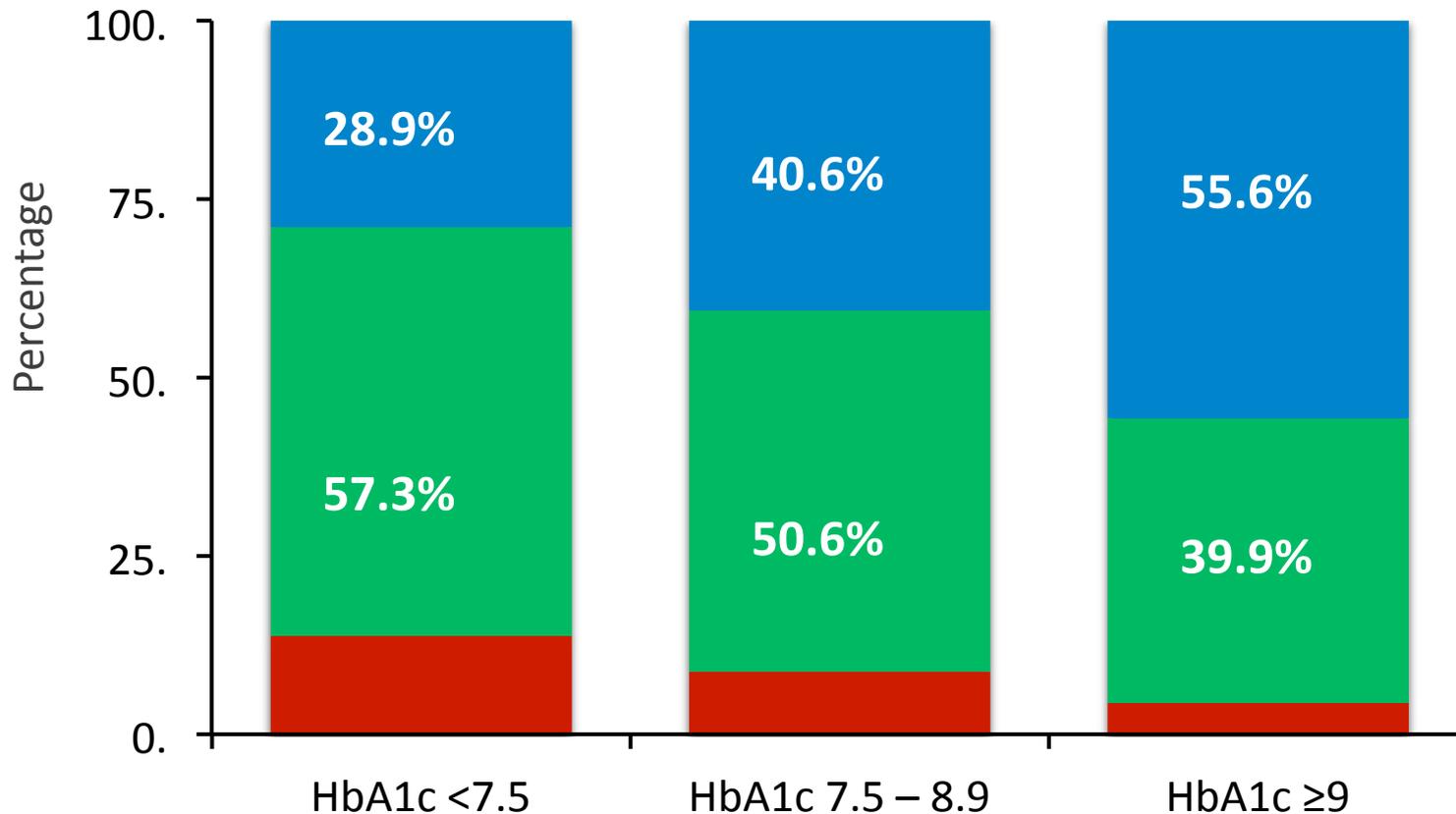
## Common theme

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- check the basics
  - Basal : Bolus splits
  - Are basal in proportion to ICR and ISF?
  - Targets
  - Time in Range...
-

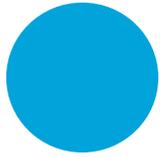
# Proportion In Range

**Figure 1:** Proportion of daily CBG results above, below and within the target range amongst the varying HbA<sub>1c</sub> groups.



# Bolus Wizard Settings

<b>80 kg Man</b>	<b>Conventional</b>	<b>Suggested</b>
Insulin: Carb	$500 / 40 = 12$	$350/\text{TDD} = 8.75$
ISF [ Correction factor]	$100/\text{TDD} = 2.5$	$120/\text{TDD} = 3.0$
BW target	4-7	4-5.5 mmol/l
Active insulin	3 hours	4 hours



# King's Pump experience

Changes in frequency of SH.

	Baseline	End of follow-up	n	p
<b>Frequency of SH</b>				
All patients	0.61 ± 1.8 0 [ 0-0]	0.3 ± 0.8 0 [ 0-0]	67	<b>0.047</b>
SH baseline ≥ 1	2.9 ± 2.9 2 [1.3-2.8]	0.6 ± 1.7 0 [ 0-0.5]	16	<b>0.01</b>

Data are expressed as mean ± SD; median [IQR]

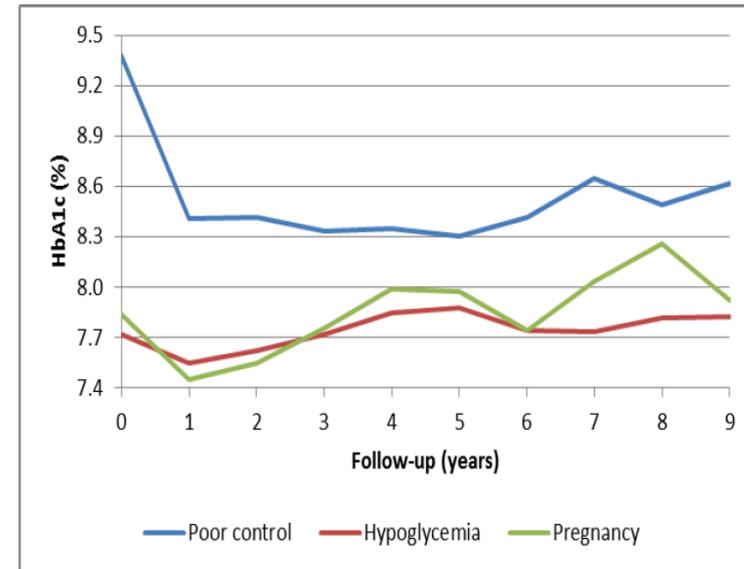
Changes in frequency of hypoglycemia per week

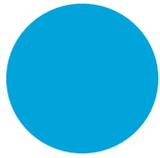
	Baseline	End of follow-up	n	p
<b>Frequency of mild or moderate hypoglycemia per week</b>				
≤ 2	52 (84)	61 (100)	163	<b>0.006</b>
3-4	20 (32)	27 (43)		
≥ 5	29 (47)	12 (20)		

Data are expressed as %(n).

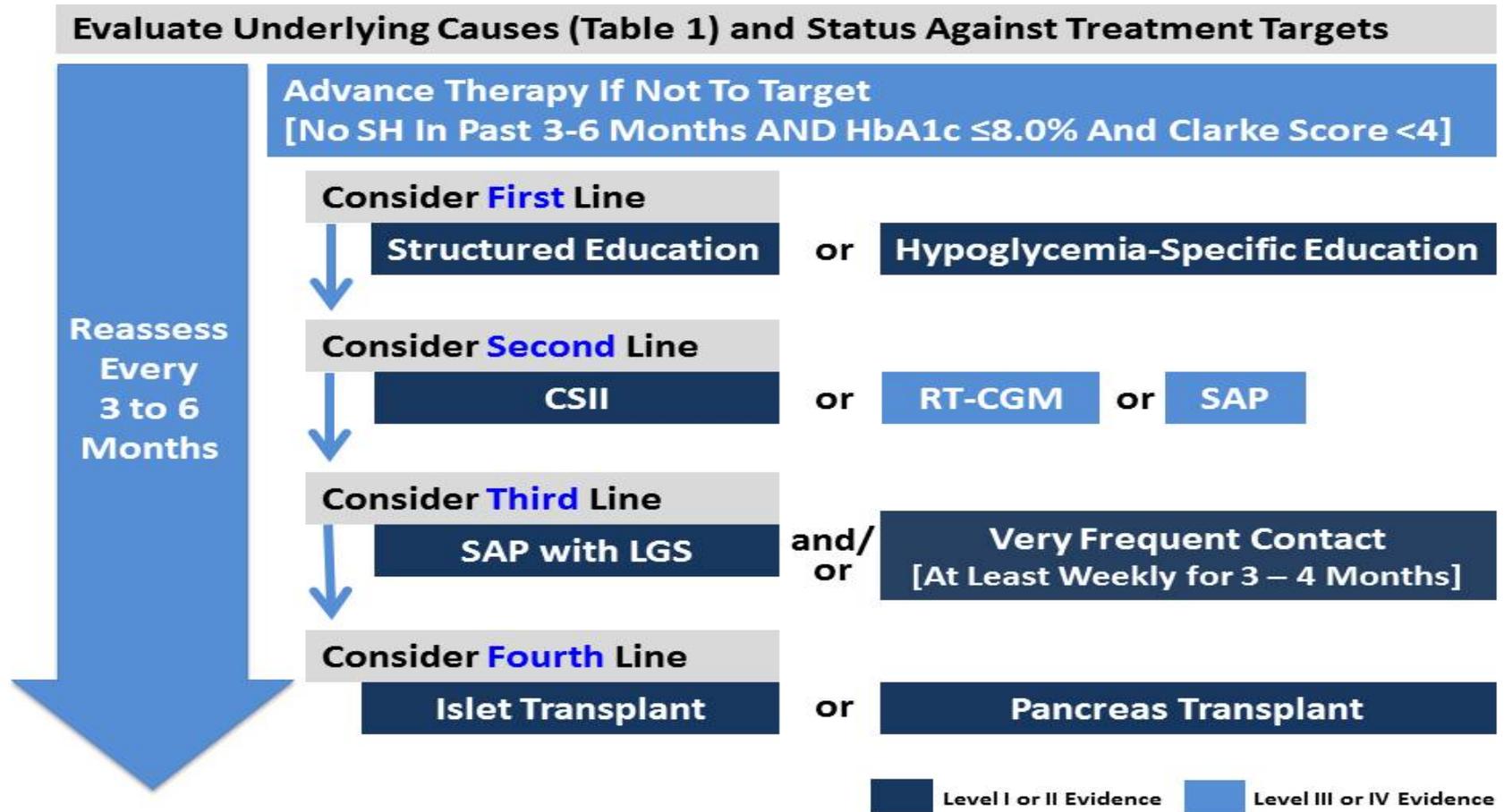
## Glycemic control

HbA1c during follow-up

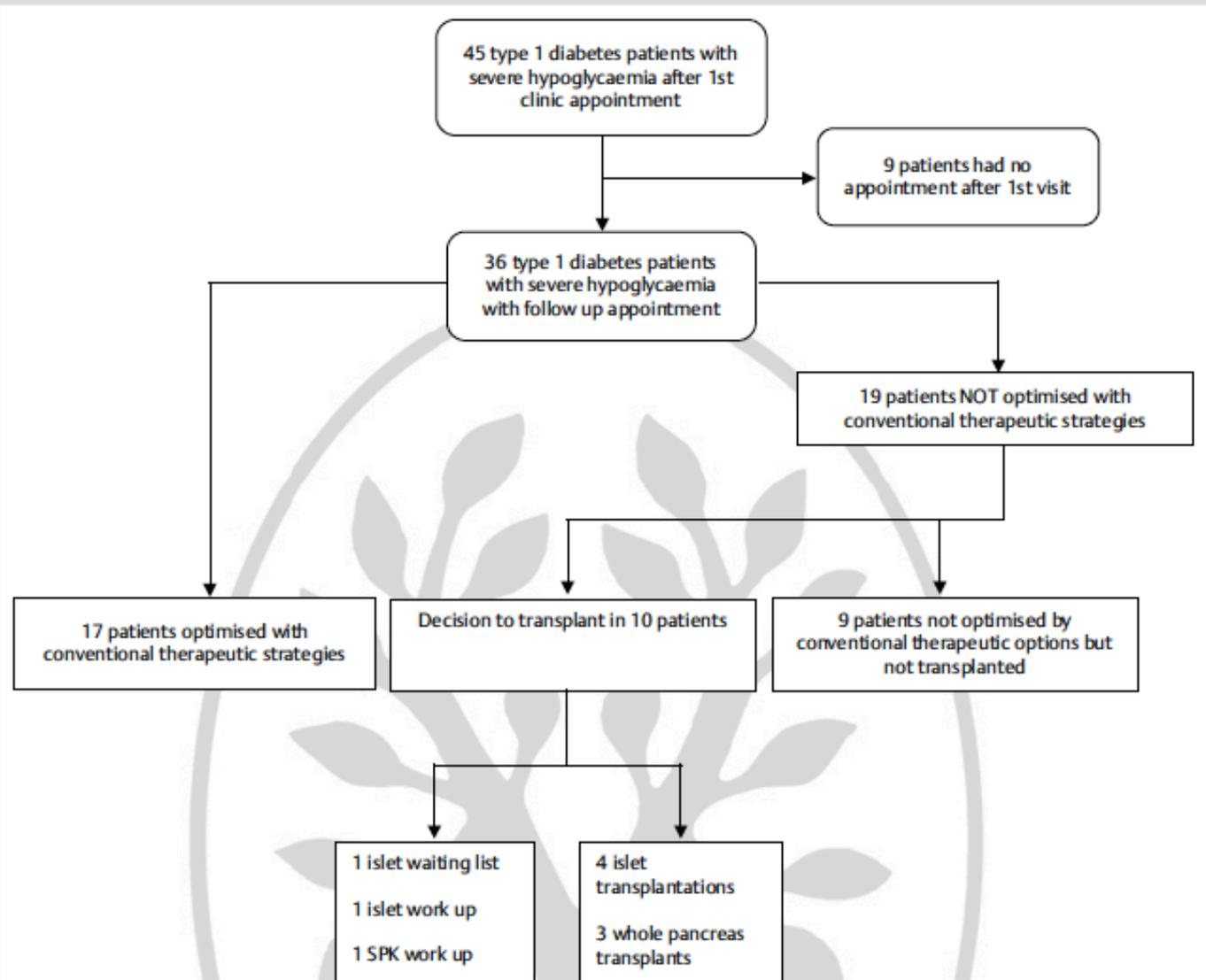




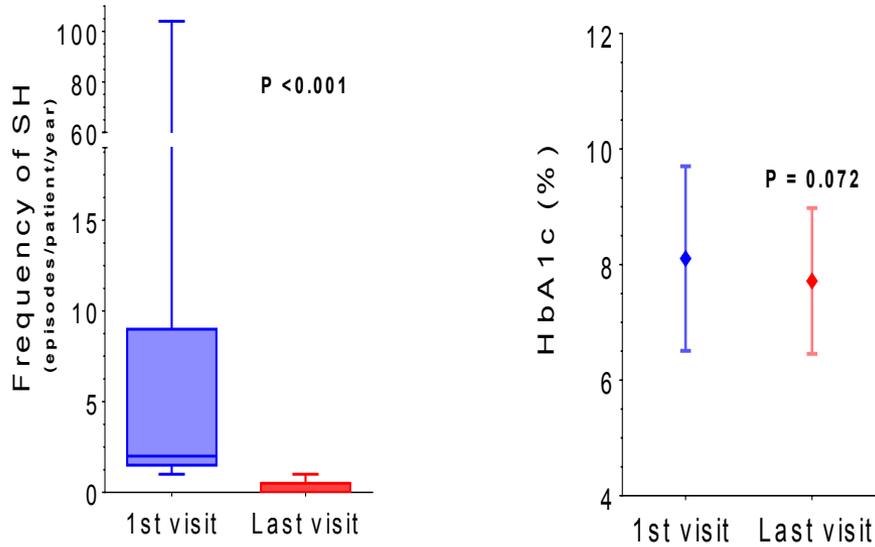
# Algorithm for problematic hypoglycaemia



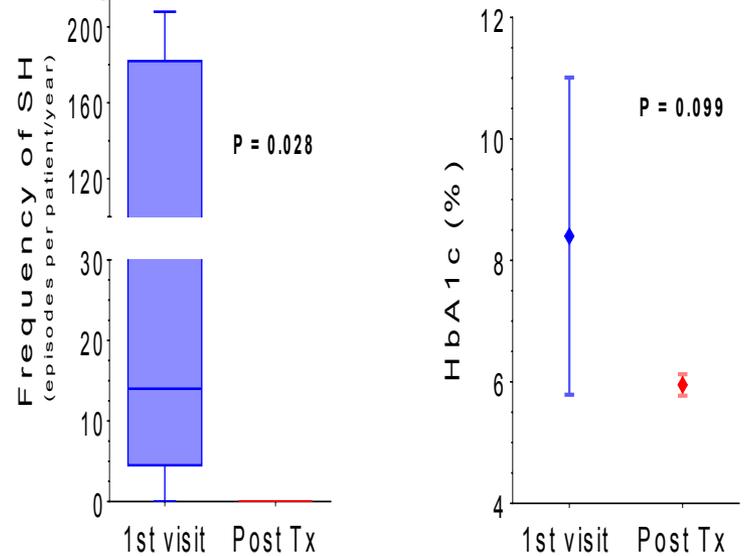
# Outcomes for Adults with Type 1 Diabetes Referred with Severe Hypoglycaemia and/or Referred for Islet Transplantation to a Specialist Hypoglycaemia Service



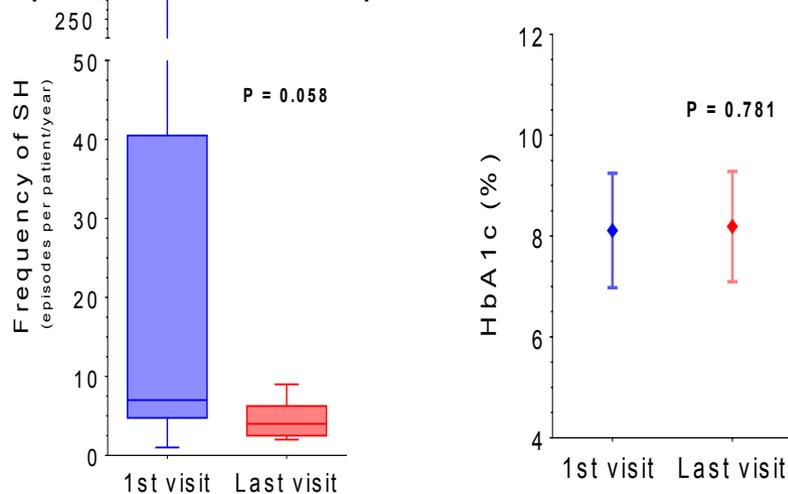
SH frequency and HbA1c in 17 patients optimised

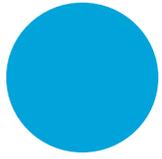


SH frequency and HbA1c in 7 patients transplanted



SH frequency and HbA1c in 9 patients not optimised & not transplanted





## Case study

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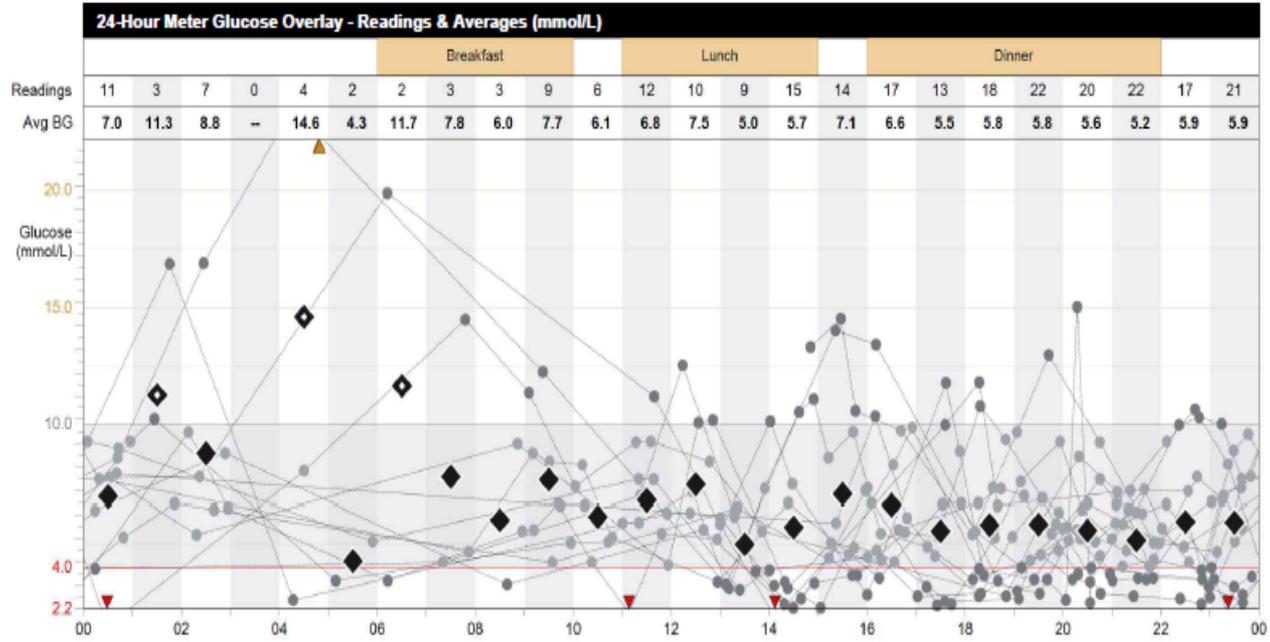
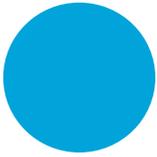
54 year old lady with 28 years of T1DM

Tight control most of the time

Problems with hypos - loss of awareness last 4 years

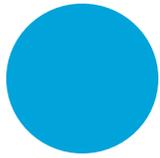
10 x paramedic call outs in the last year

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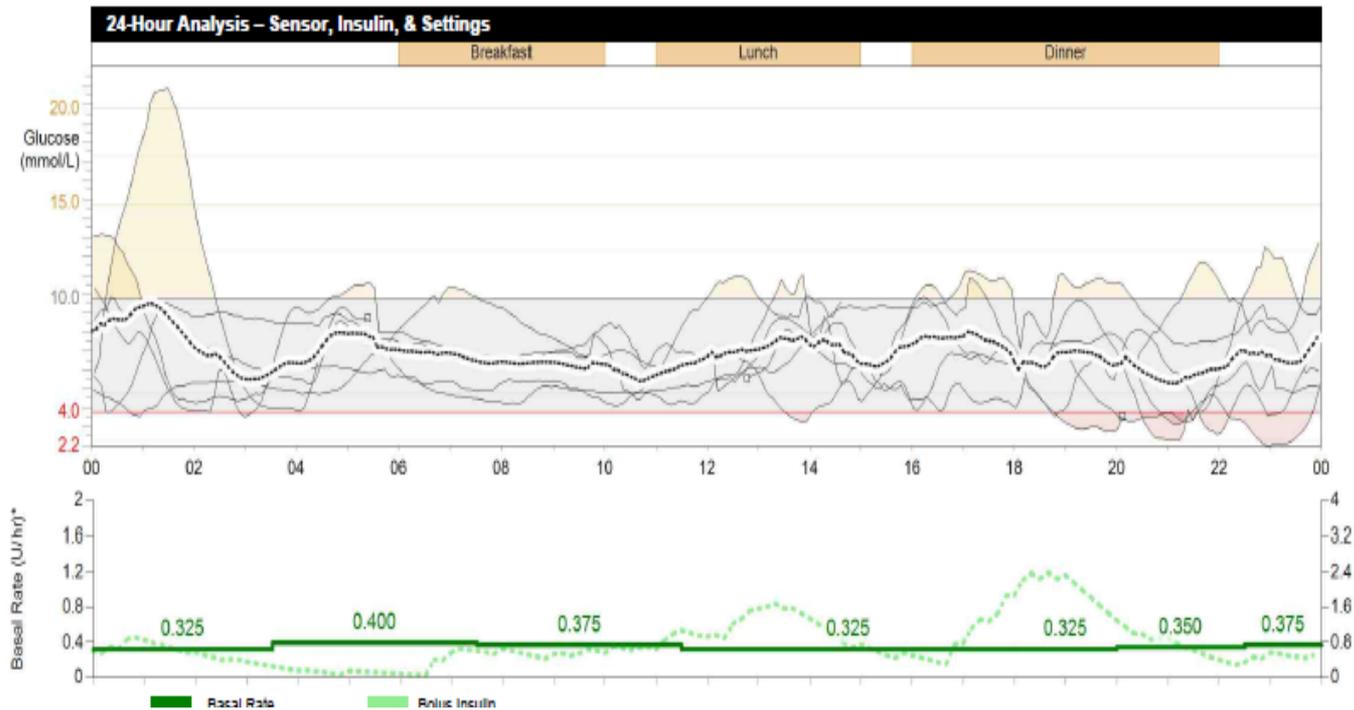


Statistics		16/10 - 29/10	
Avg BG (mmol/L)	6.4 ± 3.4		
BG Readings	260	18.2/day	
Readings Above Target	30	12%	
Readings Below Target	69	27%	
Sensor Avg (mmol/L)	--		
Avg AUC > 10.0 (mmol/L)	--		
Avg AUC < 4.0 (mmol/L)	--		
Avg Daily Carbs (g)	165 ± 55		
Carbs/Bolus Insulin (g/U)	11.2		
Avg Total Daily Insulin (U)	23.1 ± 4.7		
Avg Daily Basal (U)	8.1	35%	
Avg Daily Bolus (U)	15.0	65%	

Meter Glucose Overlay Bedtime to Wake-Up and Meal Periods - Readings & Averages (mmol/L)



# 3 months later



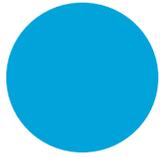
Statistics	
Avg BG	7.0 ± 2.8mmol/L
Estimated A1C	6.1%
BG Readings	18.8 per day
Carbs Entered	140 ± 55g per day

Hypoglycemic Patterns (2)	
Time Period	18:47-23:49 (6)
Time Period	13:32-14:02 (1)

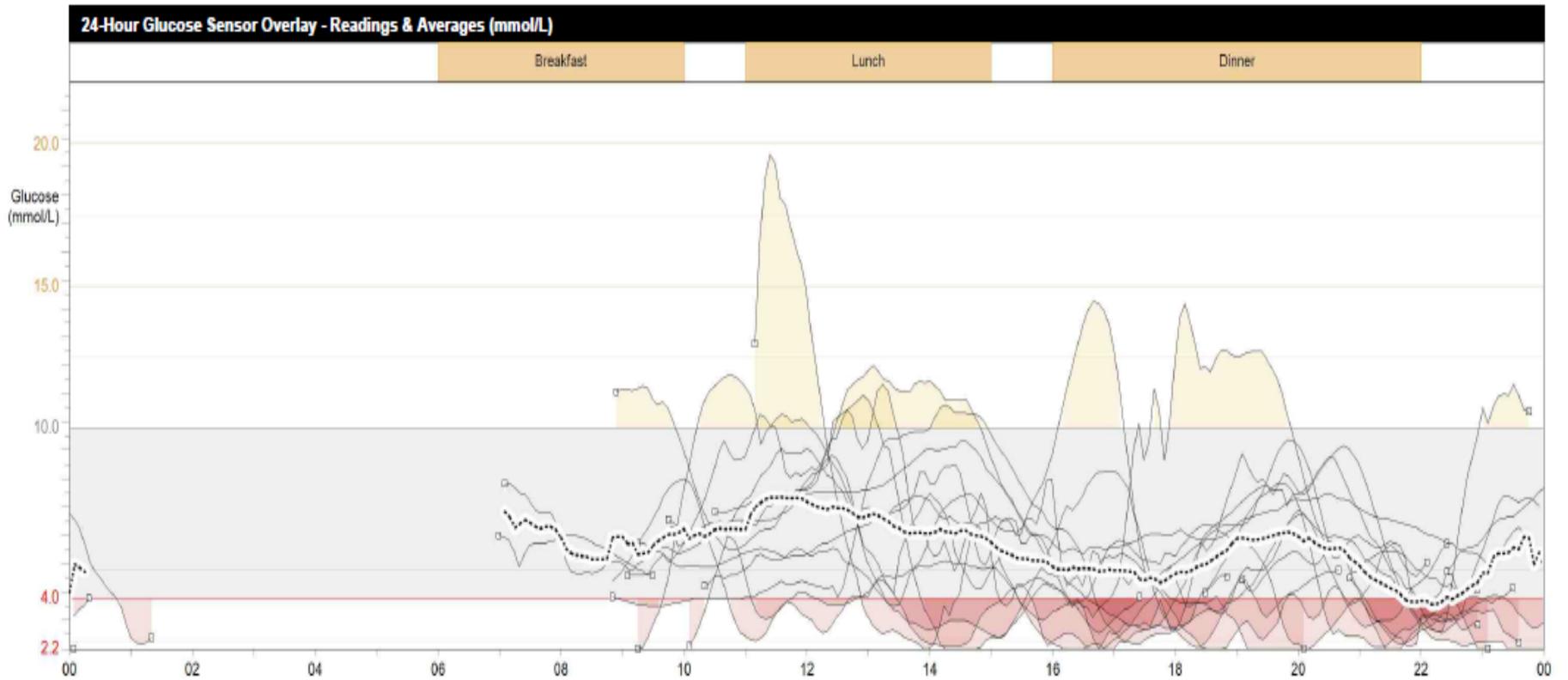
Hyperglycemic Patterns (0)	
Time Period	

Pump Use	Per Day
Insulin TDD	17.0 + 3.8 IU

Bolus Insulin (U, active 4 hr)



# 6 months later..



# Interpretation

HA perceives hypoglycaemia as

- Stressful
- Unpleasant
- Unrewarding
- With Emotional memory of this response



Internal  
motivation to  
avoid future  
episodes

IAH perceives hypoglycaemia as

- NOT stressful
- Possibly pleasant / rewarding
- With NO Emotional memory of this response



NO internal  
motivation to  
avoid  
hypoglycaemia

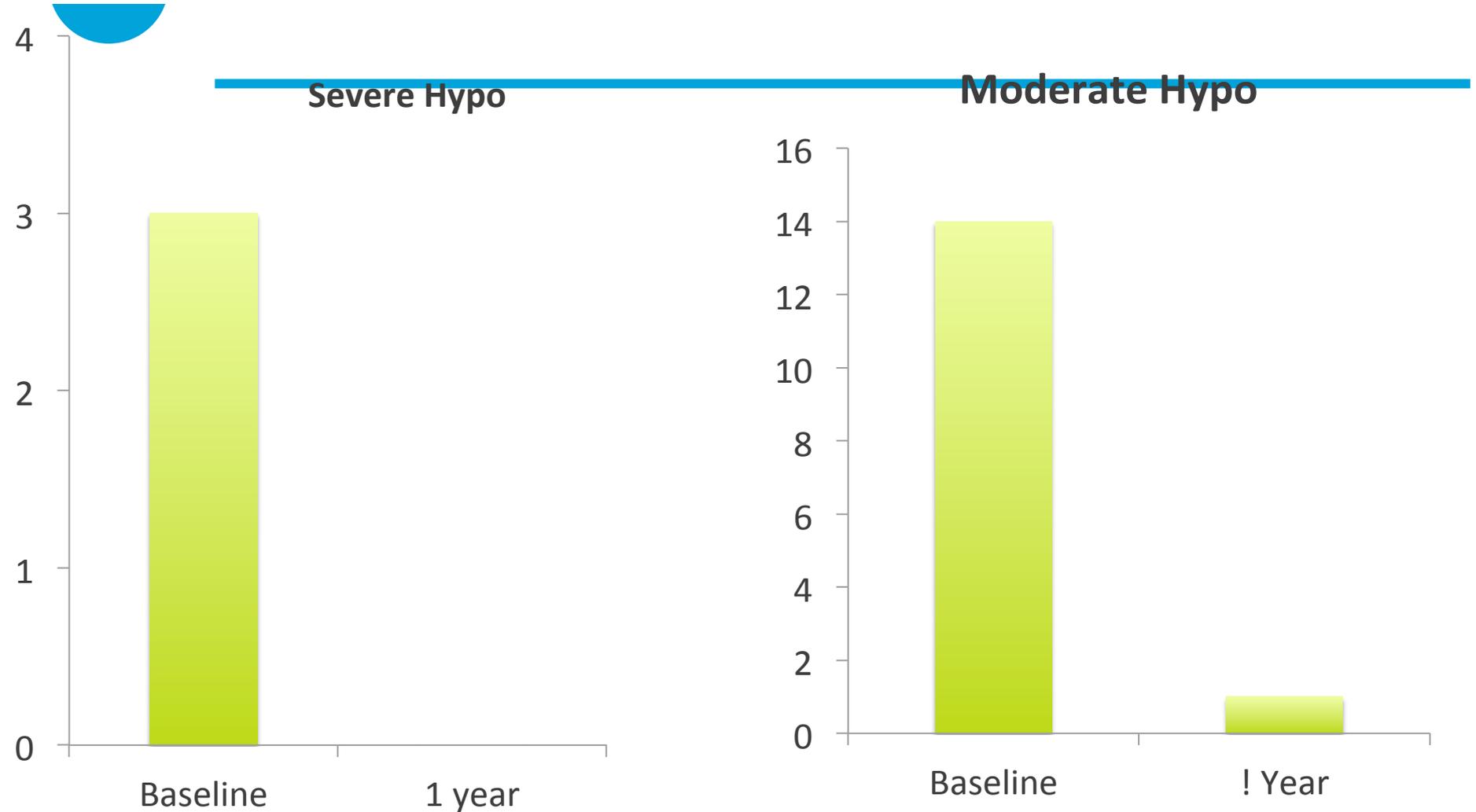
# Brain response to hypoglycaemia

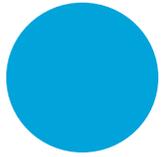


# A Psychoeducational Program to Restore Hypoglycemia Awareness: The DAFNE-HART Pilot Study

Nicole de Zoysa,<sup>1</sup> Helen Rogers,<sup>2</sup>  
Marietta Stadler,<sup>1</sup> Carla Gianfrancesco,<sup>3</sup>  
Susan Beveridge,<sup>3</sup> Emma Britneff,<sup>1</sup>  
Pratik Choudhary,<sup>1</sup> Jackie Elliott,<sup>4</sup>  
Simon Heller,<sup>4</sup> and Stephanie A. Amiel<sup>1</sup>

PARTNERS





# Current RCT

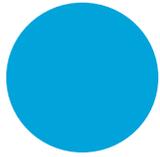
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HARPdoc vs BGAT

Role of technology...

Sensors vs pumps

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## Tips from a “hypo” service

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- Brush up Carb counting skills
- Rectify basal to bolus ratio
- Ideally 50:50 [ adults]
- Pre-meal bolus [ 10-15 mins ]
- Soften Corrections
- less aggressive correction factor [ 130-40 / TDD ]
- Address Lipohypertrophy / site problems
- Variability in insulin absorption
- DON'T need to deteriorate control
- Focus on avoiding hypos – not creating hypers
- Management of exercise / alcohol