Hypoglycaemia: a problem with many faces

A Symposium on the occasion of the 54th Annual Meeting of the European Association for the Study of Diabetes

3 October 2018

Berlin, Germany

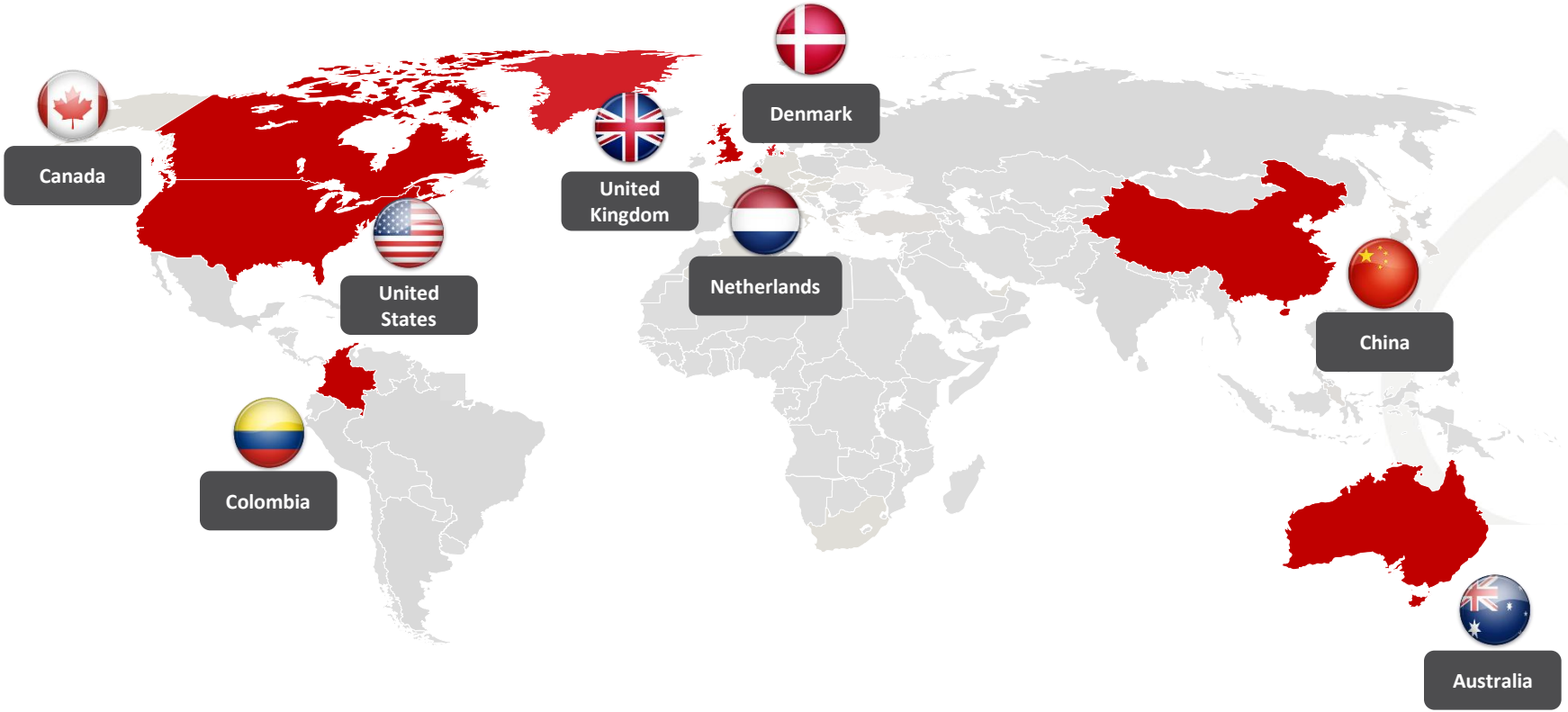
Brought to you by members of the International Hypoglycaemia Study Group

IHSG

Welcome and introduction

Simon Heller, BA, MB, Bchir, DM, FRCP
Professor of Clinical Diabetes
University of Sheffield
Director of Research and Development and
Honorary Consultant Physicain
Sheffield Teaching Hospitals NHS Foundation Trust
Sheffield, United Kingdom

IHSG Global Reach



IHSG Members







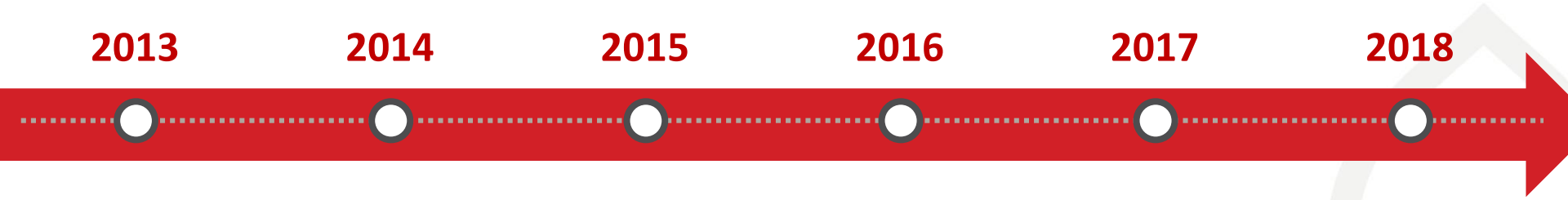









Look at how far we've come



2013

ADA Chicago
First Meeting

2014

EASD Vienna
Symposium

2015

IDF Vancouver
Meet the Experts

2016

HCP Education
Slide Deck

Classification of
Hypoglycaemia Publication

WCPD9 Atlanta
Symposium

2017

IHSG Website
Launch

EASD Lisbon
Symposium

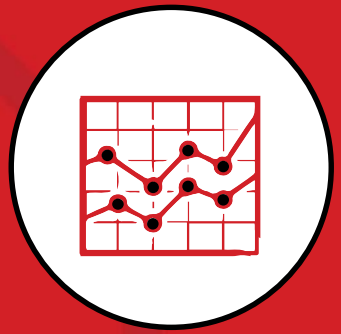
IDF Abu Dhabi
Symposium

2018

HCP and
Patient Tools

EASD Berlin
Symposium

Why hypoglycaemia matters



Higher incidence of hypoglycaemia occurs as patients move closer to HbA_{1c} treatment targets

It is an under-recognized problem that deserves increased awareness

There is a lack of understanding by both professionals and patients

A better understanding can increase patient quality of life

A look at today's symposium

IHSG International HYPOGLYCAEMIA Study Group

18:50–19:10
Update on hypoglycaemia risk factors
Yingying Luo

19:10–19:30
Hypoglycaemia in children
Tim Jones

19:30–19:50
Hypoglycaemia and the family
Stephanie Amiel

19:50–20:10
Panel discussion
Simon Heller, Yingying Luo, Tim Jones, Stephanie Amiel

20:10–20:15
Concluding remarks
Simon Heller

The International Hypoglycaemia Study Group (IHSG) is supported through a grant by Novo Nordisk A/S and is consistent with its ongoing commitment in diabetes

Remember, if you have questions for our speakers….

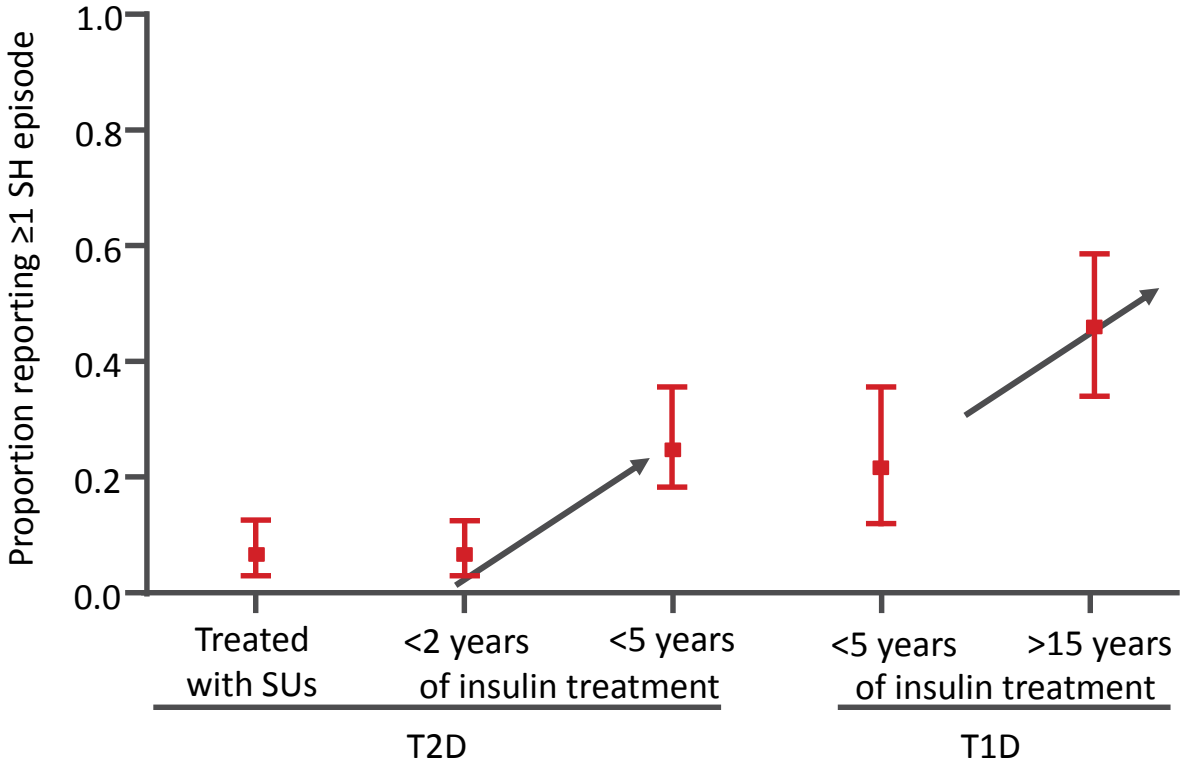
You can **submit questions** at any time by filling out a question card

Question cards will be collected in between sessions and will be answered during the panel discussion

Update on hypoglycaemia risk factors

Yingying Luo, MD
Associate Professor
Peking University People's Hospital
Beijing, China

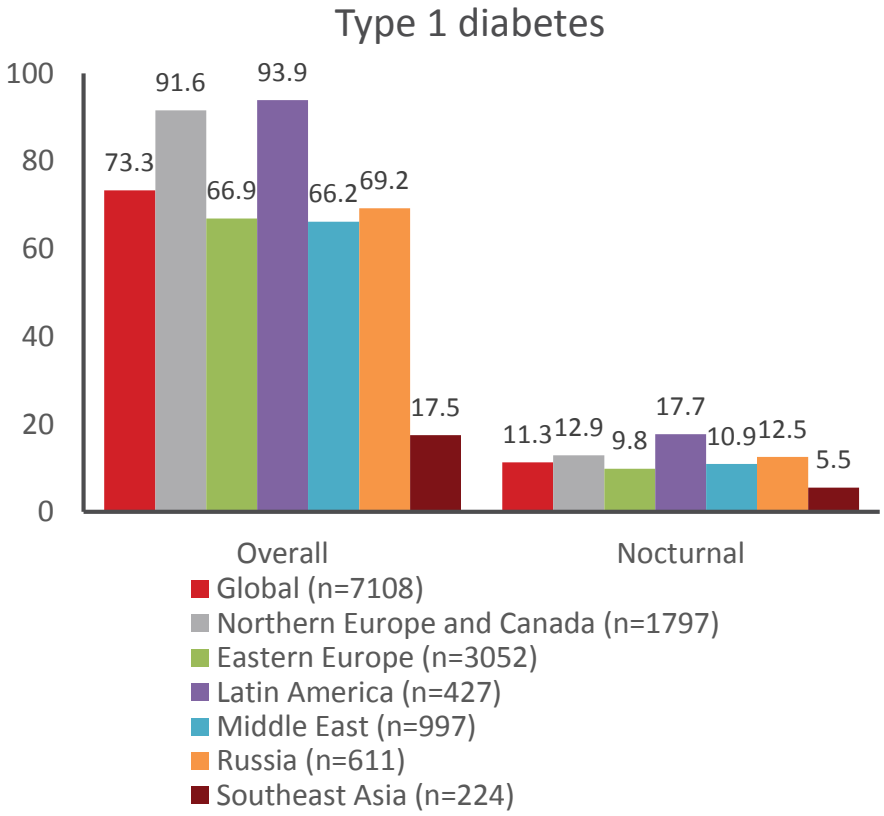
Annual prevalence of severe hypoglycaemia in type 1 and 2 diabetes

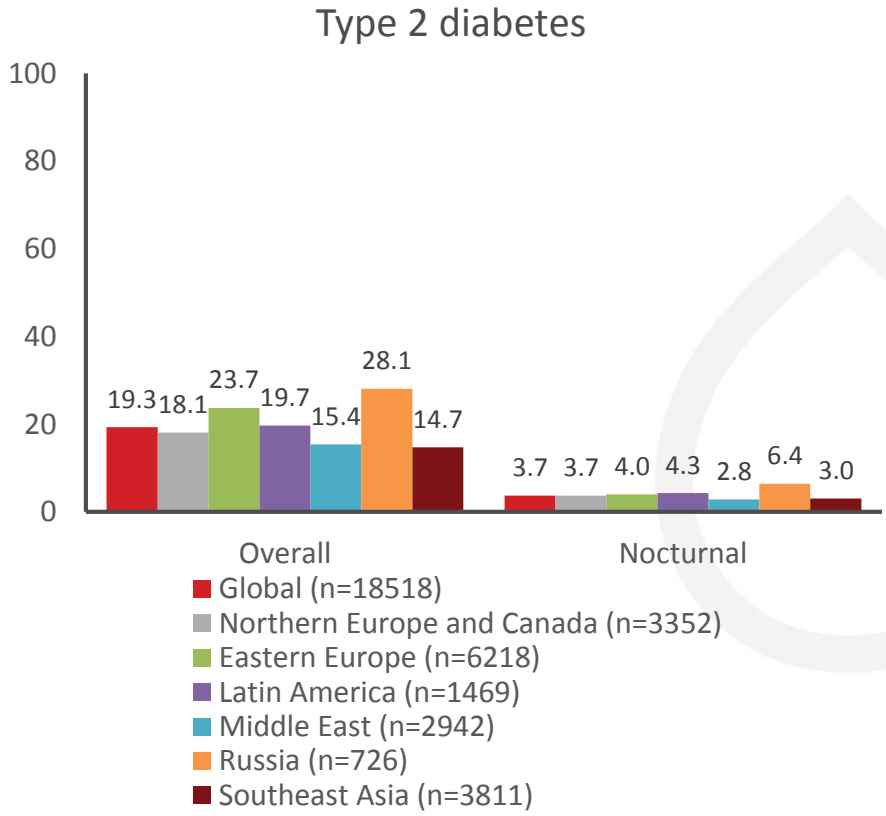


SH, severe hypoglycaemia; SU, sulfonylurea.

UK Hypoglycaemia Study Group, *Diabetologia* 2007;50:1140–7.

Prospective hypoglycaemia rates in diabetes worldwide





Annual rate denotes estimated number of events per patient-year. Rates calculated from full analysis set.
Novo Nordisk data on file.

Impact of hypoglycaemia

Brain
Coma, seizures, cognitive dysfunction, psychological effects

Cardiovascular
Myocardial ischemia, cardiac arrhythmias

Musculoskeletal
Falls, accidents, fractures, dislocations, driving mishaps

Increased  **mortality**

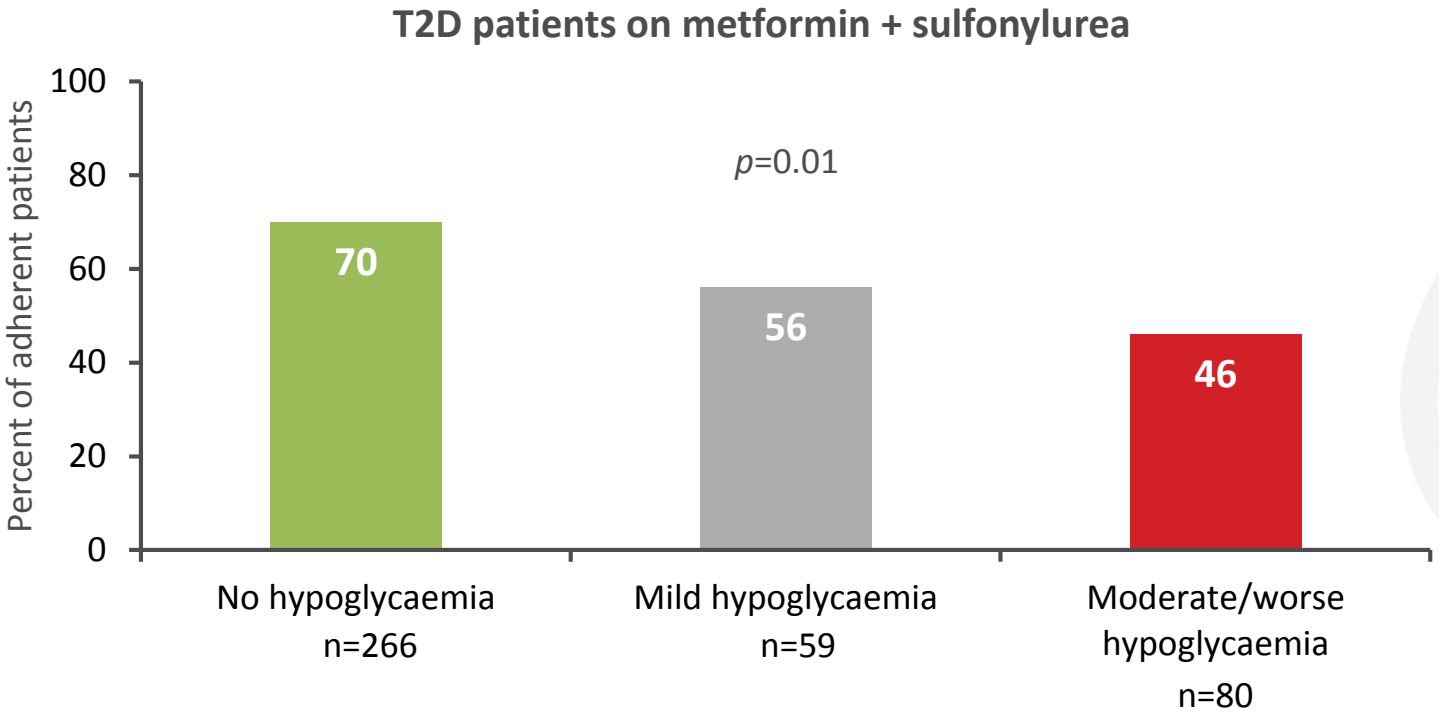
Impact of non-severe hypoglycaemia on QOL

- Reduced QOL in both T1D and T2D[1]
- QOL significantly affected in T2D patients (HYPO study)[2]
- Depressive symptoms and inability to carry out daily activities[3]
- Significant work-time loss in a study of 7 European countries and a multinational survey[4,5]
- QOL effect is greater for nocturnal than daytime events[6]

QOL, quality of life.

1. Fidler C et al. *J Med Econ* 2011;14:646–55; 2. Rombopoulos G et al. *Hormones* 2013;12:550–8;
3. Barendse S et al. Diabet Med 2012; 29: 293–302; 4. Geelhoed-Duijvestijn PH et al. J Med Econ 2013;16:1453–61;
5. Brod M et al. Valu*e Health* 2011;14:665–71; 6. Frier BM et al. *Diabet Med* 2016;33:1125–32.

Impact of hypoglycaemia on adherence

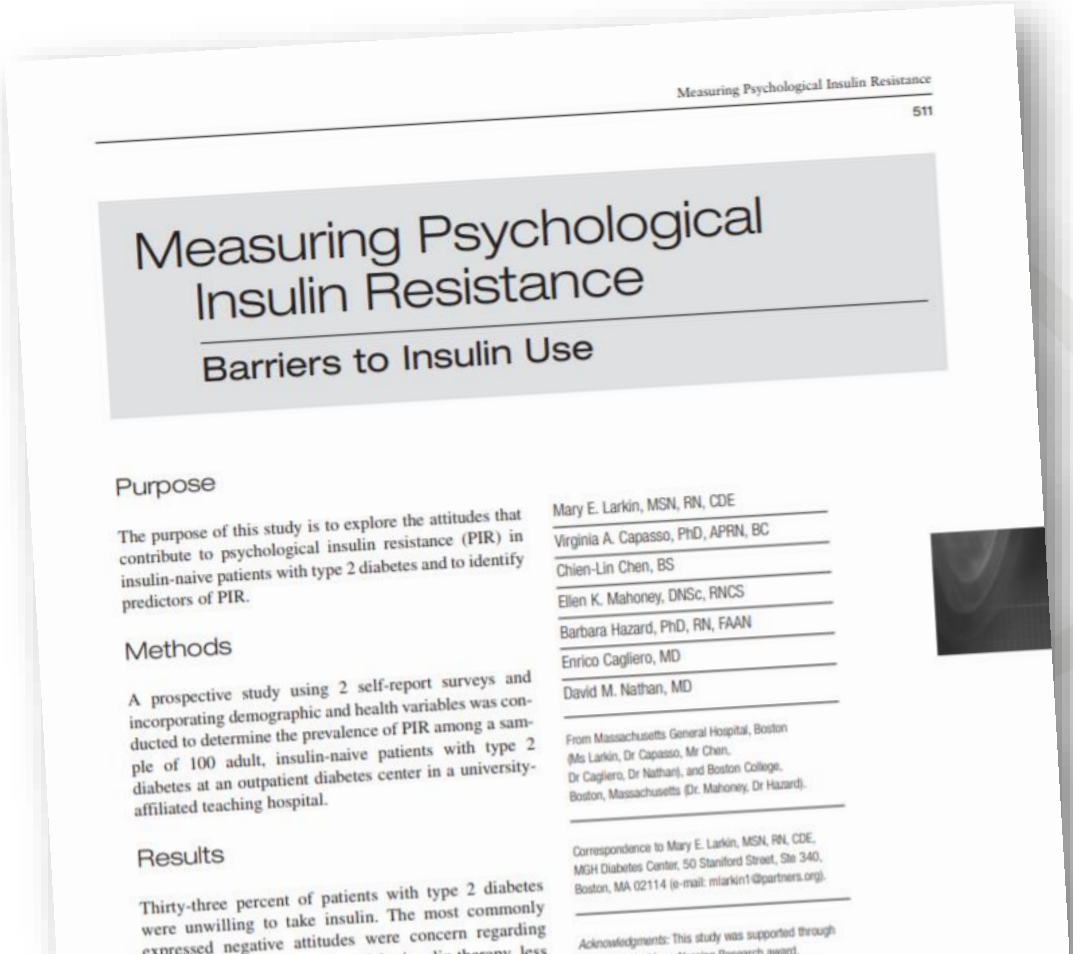


Walz L et al. *Patient Prefer Adherence* 2014;8:593–601.

Fear of hypoglyaemia: impact on treatment

Prospective study of 100 insulin-naïve adults with type 2 diabetes – personal barriers to starting insulin

- 33% were unwilling to start insulin
- Fear of hypoglycaemia was the most common personal barrier
- Other common barriers included concerns about permanent need for insulin, less flexible regimen, and feelings of failure



Measuring Psychological Insulin Resistance 511

Measuring Psychological Insulin Resistance

Barriers to Insulin Use

Mary E. Larkin, MSN, RN, CDE
Virginia A. Capasso, PhD, APRN, BC
Chien-Lin Chen, BS
Ellen K. Mahoney, DNSc, RNCS
Barbara Hazard, PhD, RN, FAAN
Enrico Cagliero, MD
David M. Nathan, MD

From Massachusetts General Hospital, Boston (Ms Larkin, Dr Capasso, Mr Chen, Dr Cagliero, Dr Nathan), and Boston College, Boston, Massachusetts (Dr. Mahoney, Dr Hazard).

Correspondence to Mary E. Larkin, MSN, RN, CDE, MGH Diabetes Center, 50 Staniford Street, Ste 340, Boston, MA 02114 (e-mail: mlarkin1@partners.org).

Acknowledgments: This study was supported through

Purpose

The purpose of this study is to explore the attitudes that contribute to psychological insulin resistance (PIR) in insulin-naive patients with type 2 diabetes and to identify predictors of PIR.

Methods

A prospective study using 2 self-report surveys and incorporating demographic and health variables was conducted to determine the prevalence of PIR among a sample of 100 adult, insulin-naive patients with type 2 diabetes at an outpatient diabetes center in a university-affiliated teaching hospital.

Results

Thirty-three percent of patients with type 2 diabetes were unwilling to take insulin. The most commonly expressed negative attitudes were concern regarding

Larkin ME et al. *Diabetes Educ* 2008;34:511–7.

Case study: Mr. Lee

- Mr Lee: 72 years old, lives alone
- Type 2 diabetes for 15 years
- On metformin 500 mg tid, glimepiride 4 mg qd and NPH 20 U at bed time
- Recent HbA_{1c}: 6.7% (2 months ago)
- Always feels hungry before bed. Sometimes wakes up at 3–5 am and feels palpitations
  - Discomfort always disappears after eating
- Very few SMBG readings
- Past history: CABG 2 years ago
- Personal history: No habit of smoking; drinks beer or alcohol before dinner everyday

CABG, coronary artery bypass grafting; NPH, neutral protamine Hagedorn; qd, once-daily; SMBG, self-measured blood glucose; tid, thrice-daily.

Do you think the patient has good glycaemic control?

A. Yes

B. No

Which risk factors in the case do you think are modifiable?

A. Strict glycaemic control

B. On glimepiride and NPH

C. Alcohol consumption

D. Lack of SMBG

E. All of the above

Risk factors for hypoglycaemia

Non-modifiable risk factors

- Older age
- Diabetes duration
- Kidney damage
- History of severe hypoglycaemia
- Emotional disorders
- Patients using CNS depressing agents
- Genetic factors
- Comorbidity

Impaired awareness of hypoglycaemia

Modifiable risk factors

- Poor glycaemic control (include low HbA_{1c} under the ideal target)
- Glucose-lowering medication use
- Alcohol and other substances
- Lack of knowledge
- Limited access to the glucose monitoring devices

CNS, central nervous system.

Non-modifiable risk factors associated with hypoglycaemia

Risk factor	Cases (N=690)	Controls (N=6900)	Crude OR (95% CI)	Adj OR (95% CI)
Age				
20–59	114 (16.5)	2195 (31.8)	1.00 (reference)	1.00 (reference)
60–74	231 (33.5)	3012 (43.6)	1.55 (1.22–1.95)	1.19 (0.90–1.56)
≥75	345 (50.0)	1693 (24.5)	4.26 (3.39–5.36)	2.27 (1.65–3.12)

CI, confidence interval; CVD, cardiovascular disease; OR, odds ratio.
Bruderer SG et al. *Diabetes Obes Metab* 2014;16:801–11.

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Renal failure prior to index date				
No	323 (46.8)	4971 (72.0)	1.00 (reference)	1.00 (reference)
Yes	367 (53.2)	1929 (28.0)	3.30 (2.79–3.91)	1.34 (1.04–1.71)

CI, confidence interval; CVD, cardiovascular disease; OR, odds ratio.
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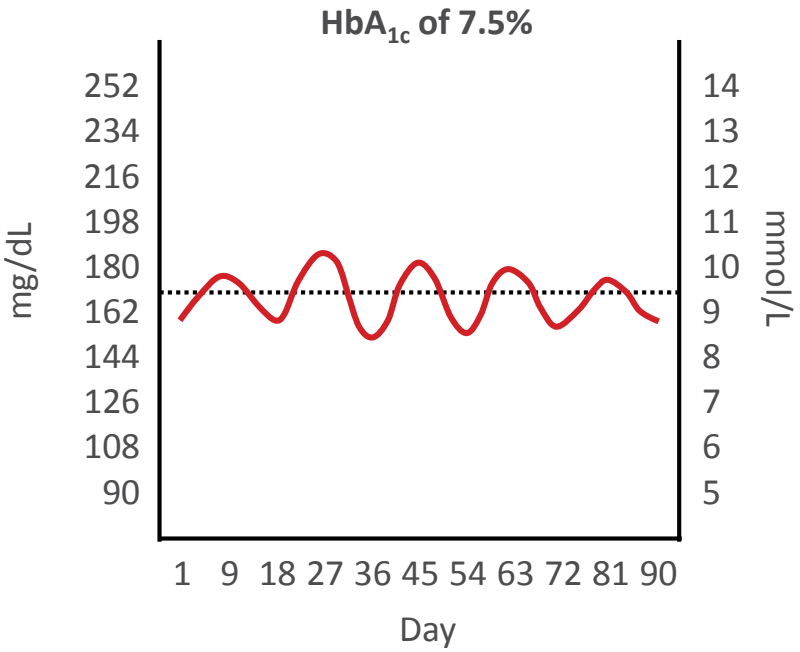
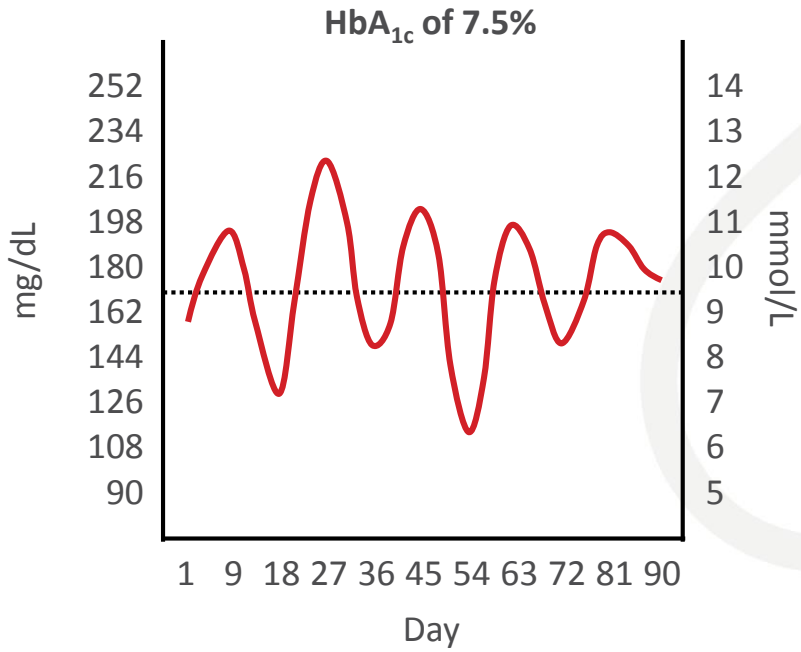
Cognitive impairment/dementia prior to index date				
No	626 (90.7)	6726 (97.5)	1.00 (reference)	1.00 (reference)
Yes	64 (9.3)	174 (2.5)	4.19 (3.08–5.71)	2.00 (1.37–2.91)

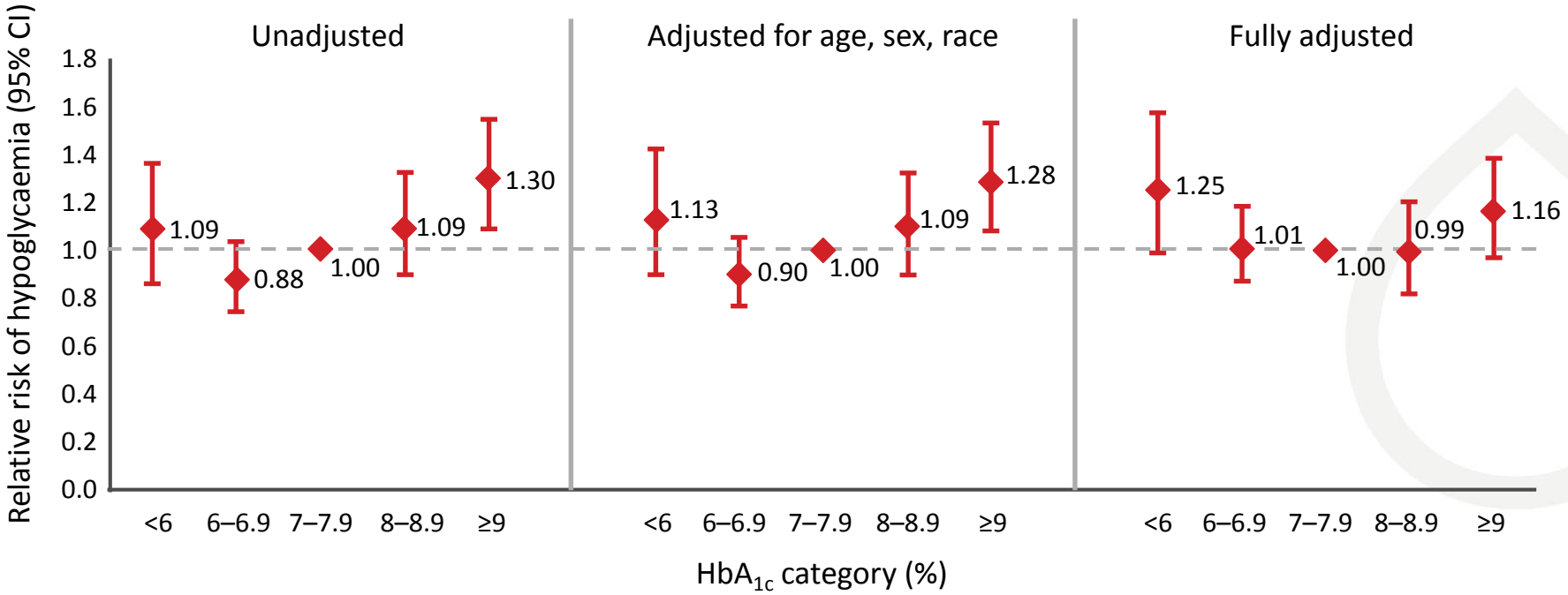
CI, confidence interval; CVD, cardiovascular disease; OR, odds ratio.
Bruderer SG et al. *Diabetes Obes Metab* 2014;16:801–11.

Glucose fluctuation and hypoglycaemia





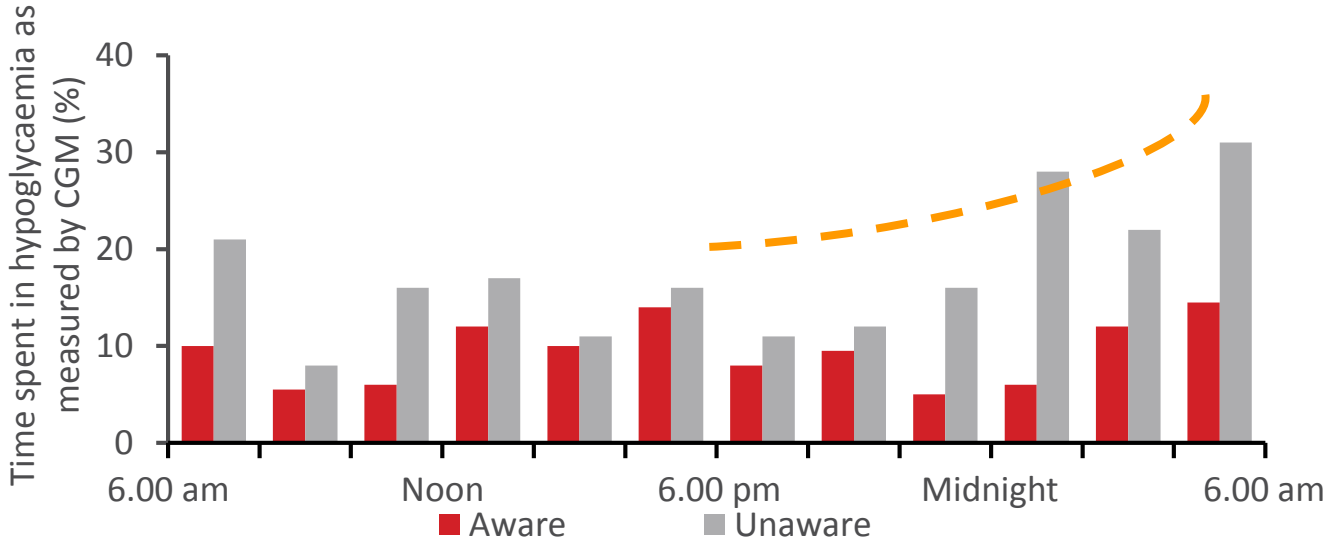
Hypoglycaemia may occur at all levels of glucose control



CI, confidence interval.

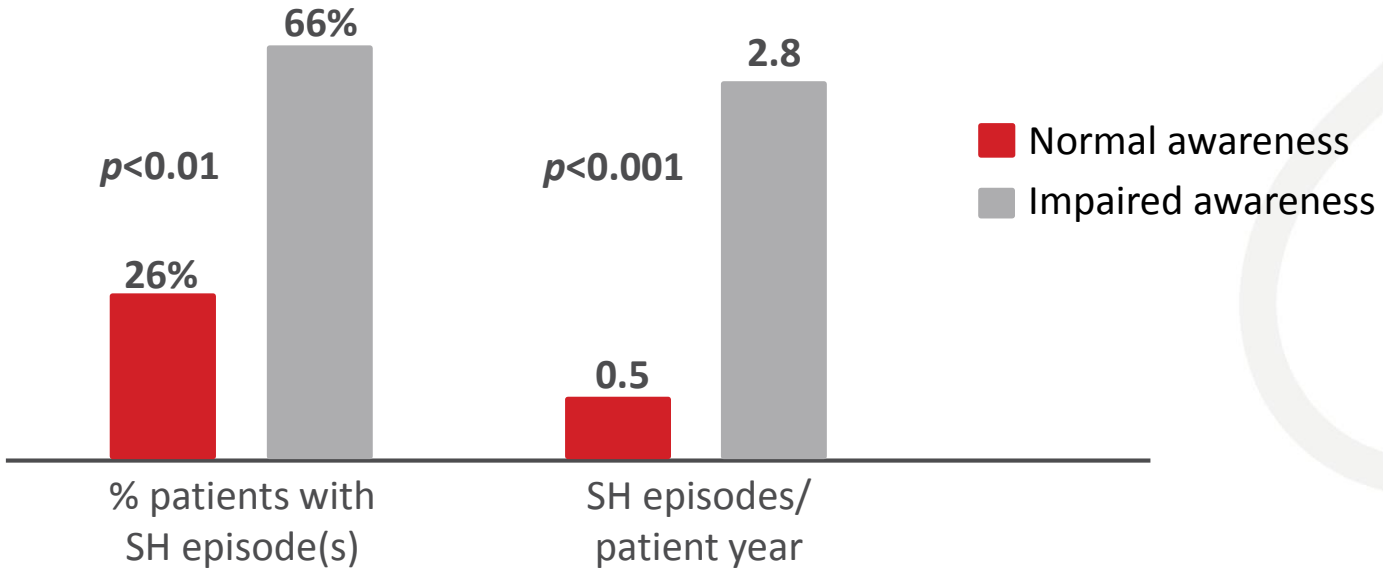
Lipska KJ et al. *Diabetes Care* 2013;36:3535–42.

Impact of IAH on hypoglycaemia at different times



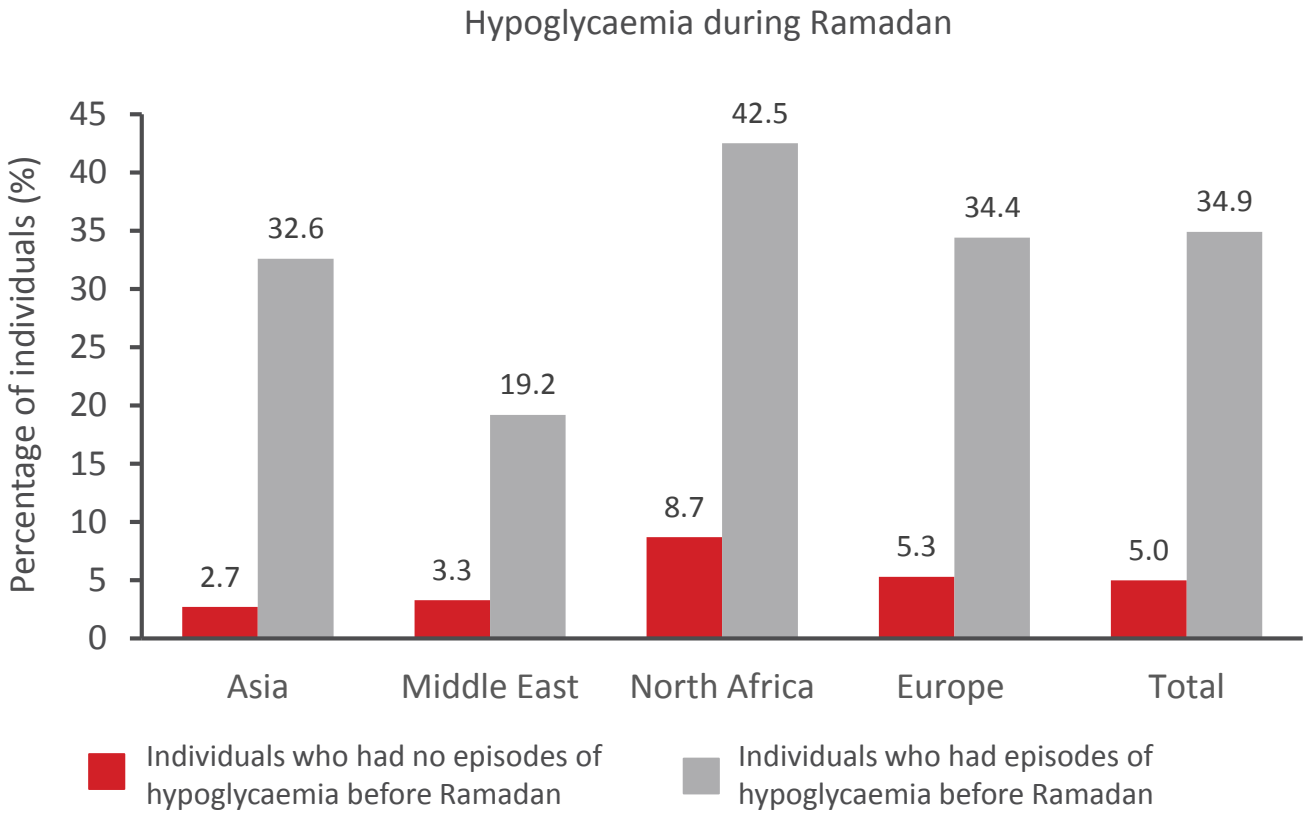
CGM, continuous glucose monitoring; IAH, impaired awareness of hypoglycaemia.
Streja D. *Endo Pract* 2005;11:83–90.

Impact of IAH on severe hypoglycaemia



IAH, impaired awareness of hypoglycaemia; SH, severe hypoglycaemia.
Gold AE et al. *Diabetes Care* 1994;7697–703.

Risk factors to be considered in special situations



Jabbar A et al. *Diabetes Res Clin Pract* 2017;132:19–26.

Which risk factors in the case do you think are modifiable now?

A. Strict glycaemic control

B. On glimepiride and NPH

C. Alcohol consumption

D. Lack of SMBG

E. All of the above

MPH, neutral protamine Hagedorn; SMBG, self-measured blood glucose.

Risk factors for Mr. Lee

Non-modifiable risk factors

- Age
- Diabetes duration
- Comorbidity

Modifiable risk factors

- Limited knowledge about hypoglycaemia
- Alcohol consumption
- No SMBG
- Glucose target
- Insulin dosage

SMBG, self-measured blood glucose.

Do you think this patient is at high risk?

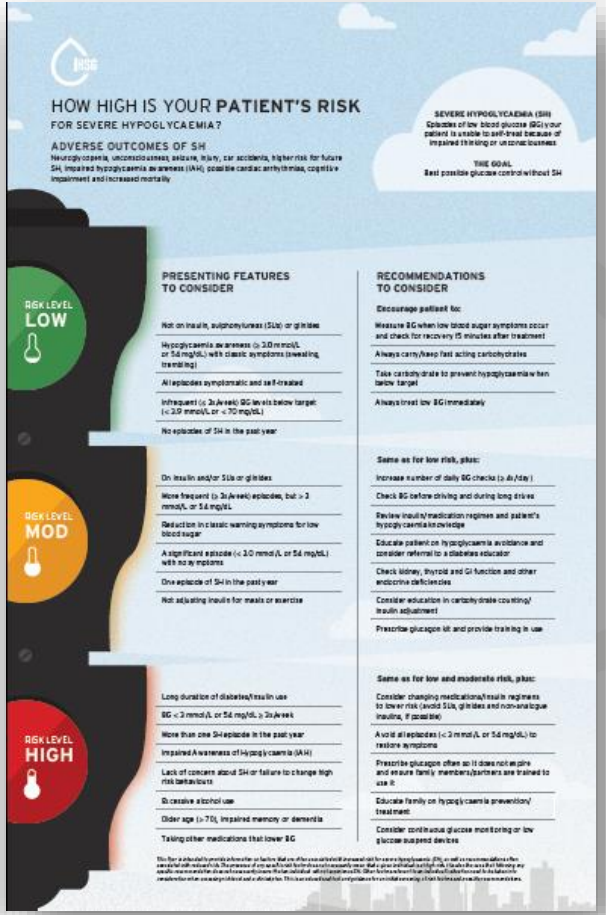
A. Yes

B. No

Recognize the high risk population

IHSG has developed a hypoglycaemia risk assessment infographic

Available at:
www.ihsgonline.com



Clinical approach to hypoglycaemia

- Establish hypoglycaemia as a key outcome in diabetes care along with HbA_{1c}
- Identify risk factors for hypoglycaemia:
  - Conventional risk factors for hypoglycaemia
  - Risk factors for reduced hypoglycaemia awareness and HAAF
- Patient and clinician education around intensive glycaemic therapy
  - Insulin, monitoring, risk factors, prevention, etc
- Technologies

HAAF, hypoglycaemia-associated autonomic failure.

Modifiable risk factors for Mr. Lee

- Provide diabetes education
- Limit the alcohol consumption
- Educate Mr. Lee to use glucose monitoring device
- Elevate the glucose target
- Stop SU and change NPH to long-acting insulin analogue

SMBG, self-measured blood glucose.

Take home messages

- Hypoglycaemia is a major problem for both type 1 and 2 diabetes patients globally
- Hypoglycaemia has many short-term and long-term impacts on patients
- Identifying high-risk populations using tools such as that provided by the IHSG may minimize the risk of hypoglycaemia
- Recognizing and modifying the risk factors of hypoglycaemia may improve disease control for the patients

Remember, if you have questions for our speakers….

Raise your hand to have question cards collected

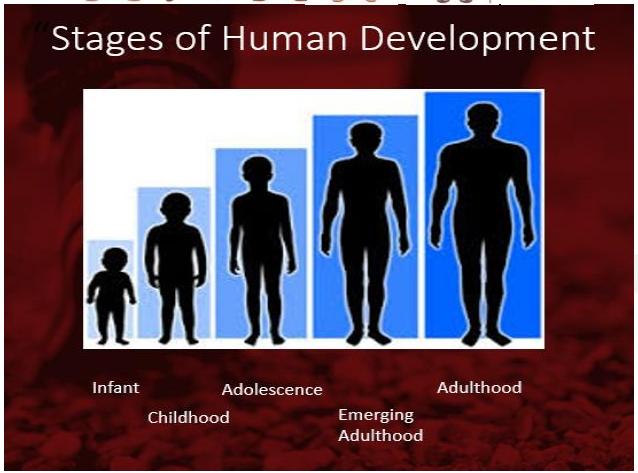
Questions will be answered during the panel discussion

Hypoglycaemia in children

Tim Jones, MBBS, FRACP, MD
Clinical Professor
Head of the Diabetes & Obesity Research team
University of Western Australia
Crawley, Australia

Childhood is not limited to one stage

Infancy, toddlerhood, early childhood, preadolescence, adolescence, post-adolescence, emerging adult…



Children are not simply “small adults”

- Physiology is different and organs are in development

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- Behaviours differ and change over time

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- Differing social contexts: family, school, other adults, culture

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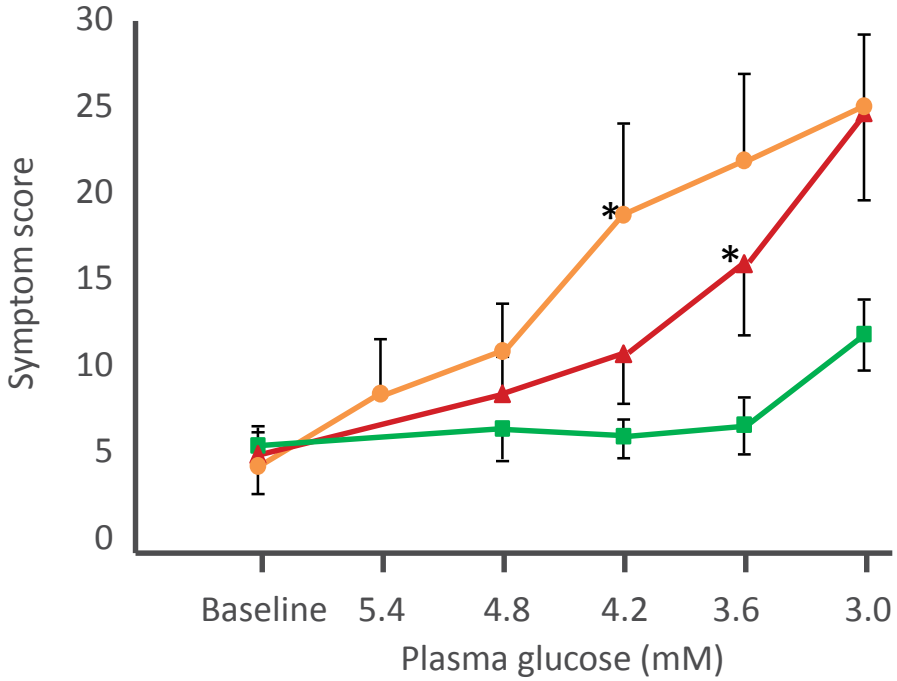
- Behaviours differ and change over time
- Differing social contexts: family, school, other adults, culture
- Diabetes and its treatment may differ from adults

Children have a unique physiology

- Insulin sensitivity changes with age
- Adolescents have different counterregulatory hormone responses than adults
  - They may trigger counter-regulation at a higher blood glucose level than adults
- Few studies performed in very young children

Amiel S et al. *N Engl J Med* 1986; 315:215–9; Jones TW et al. *Diabetes* 1991;40:385–63.

Symptom responses during hypoglycaemia



Children with T1DM, poor control

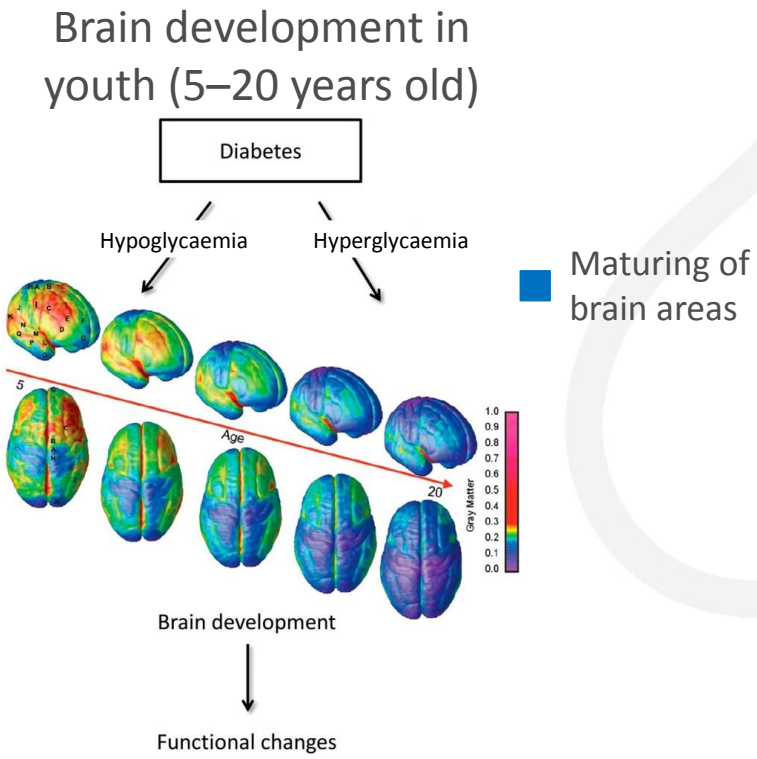
Non-diabetic children

Non diabetic adults

Jones TW et al. *Diabetes* 1991;40:385–63.

The childhood brain is developing

Maturation occurs from the back to the front of the brain

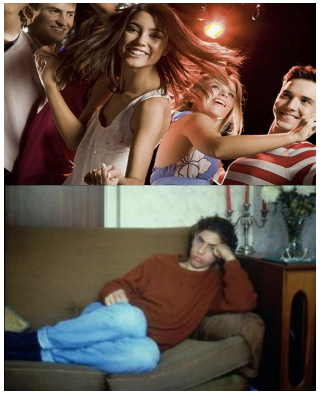


Biessels GJ and Reijmer YD. *Diabetes Care* 2014;63:62–4; Gogtay N et al. *Proc Natl Acad Sci* 2004;101:8174–9.

Children’s behaviour can be unpredictable

Children's behaviour can be unpredictable

- Nobody can make a toddler eat who doesn't want to eat
- Hypoglycaemic symptoms may be behavioural
- All young children may require assistance for hypoglycaemia
- Children may feign hypoglycaemia



- Hypoglycaemia may be a source of embarrassment for adolescents
- Risk taking, experimentation
- Mental health

Children have caretakers

Children have caretakers

Children have caretakers

Children often have to be left in the care of other adults

Children are not simply “small adults”

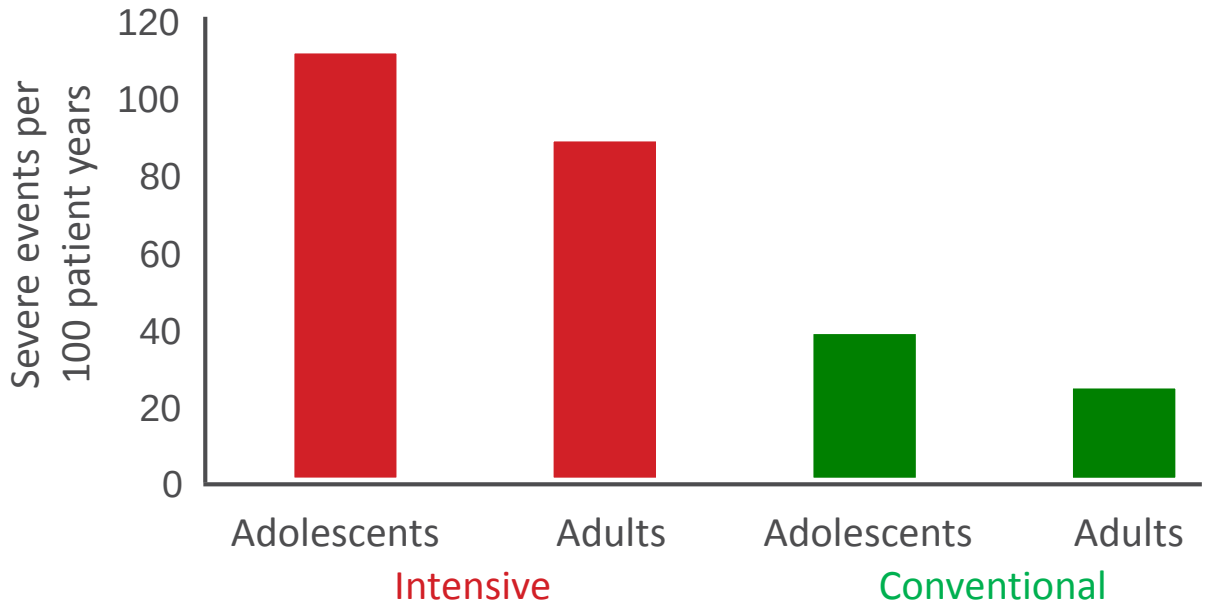
- Physiology is different and organs are in development
- Behaviours differ and change over time
- Differing social contexts: family, school, other adults, culture
- Diabetes and its treatment may differ from adults

Children are not simply “small adults”

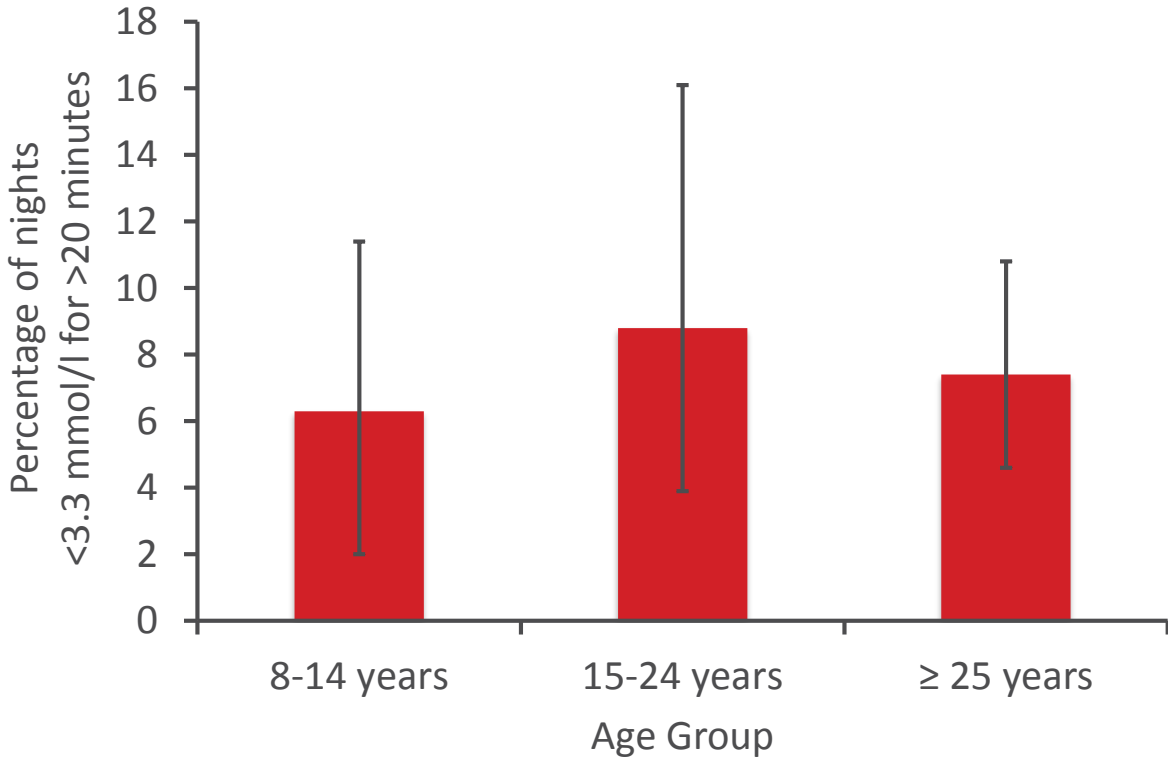
- Physiology is different and organs are in development
- Behaviours differ and change over time
- Differing social contexts: family, school, other adults, culture
- **Diabetes and its treatment may differ from adults**

- 85–95% type 1 diabetes
- C-peptide negative
- Fewer complications

Hypoglycaemia frequency: DCCT



Nocturnal hypoglycaemia: CGM detected

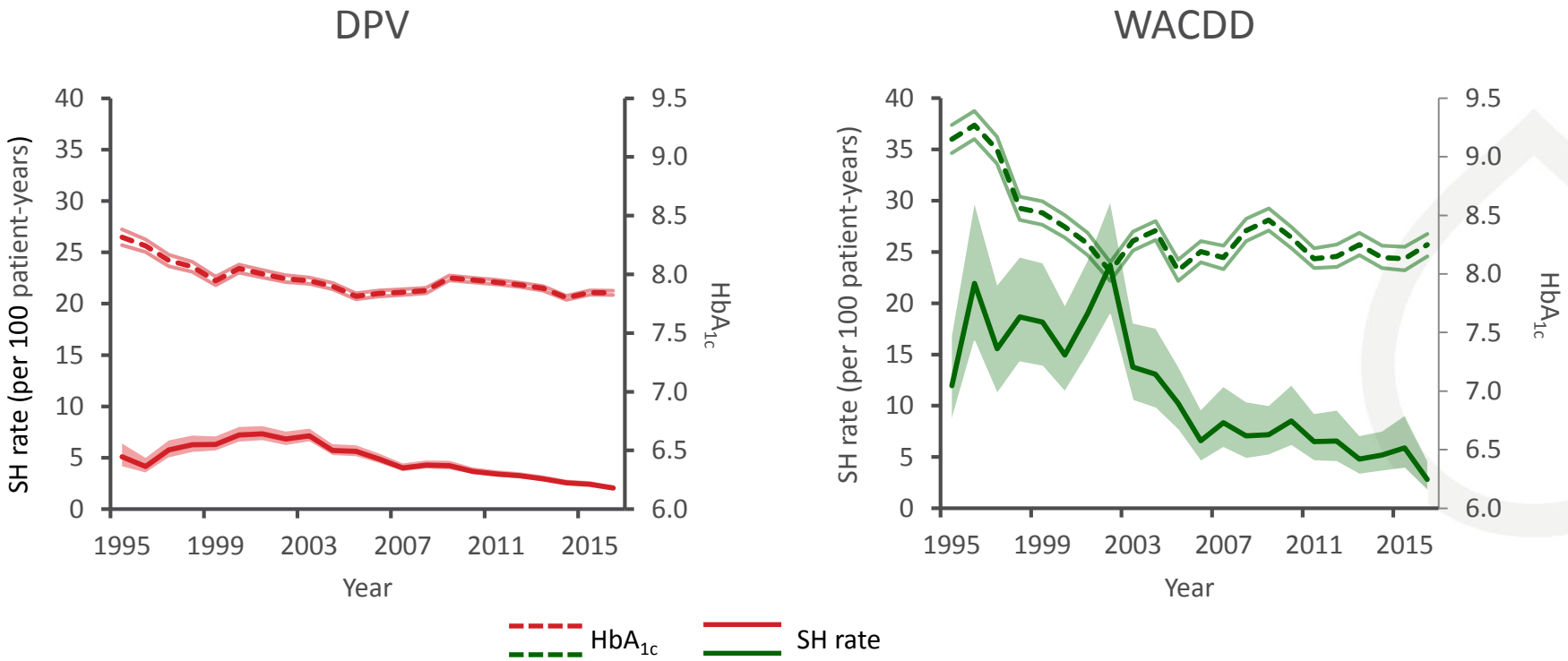


- Of all events, 25% were longer than 2 hours
- Hypoglycaemia more prolonged in adolescents vs adults
- Mean time <3.4mmol/l was 81 mins

Data are median, error bars 25-75th centile, 36,000 study nights.

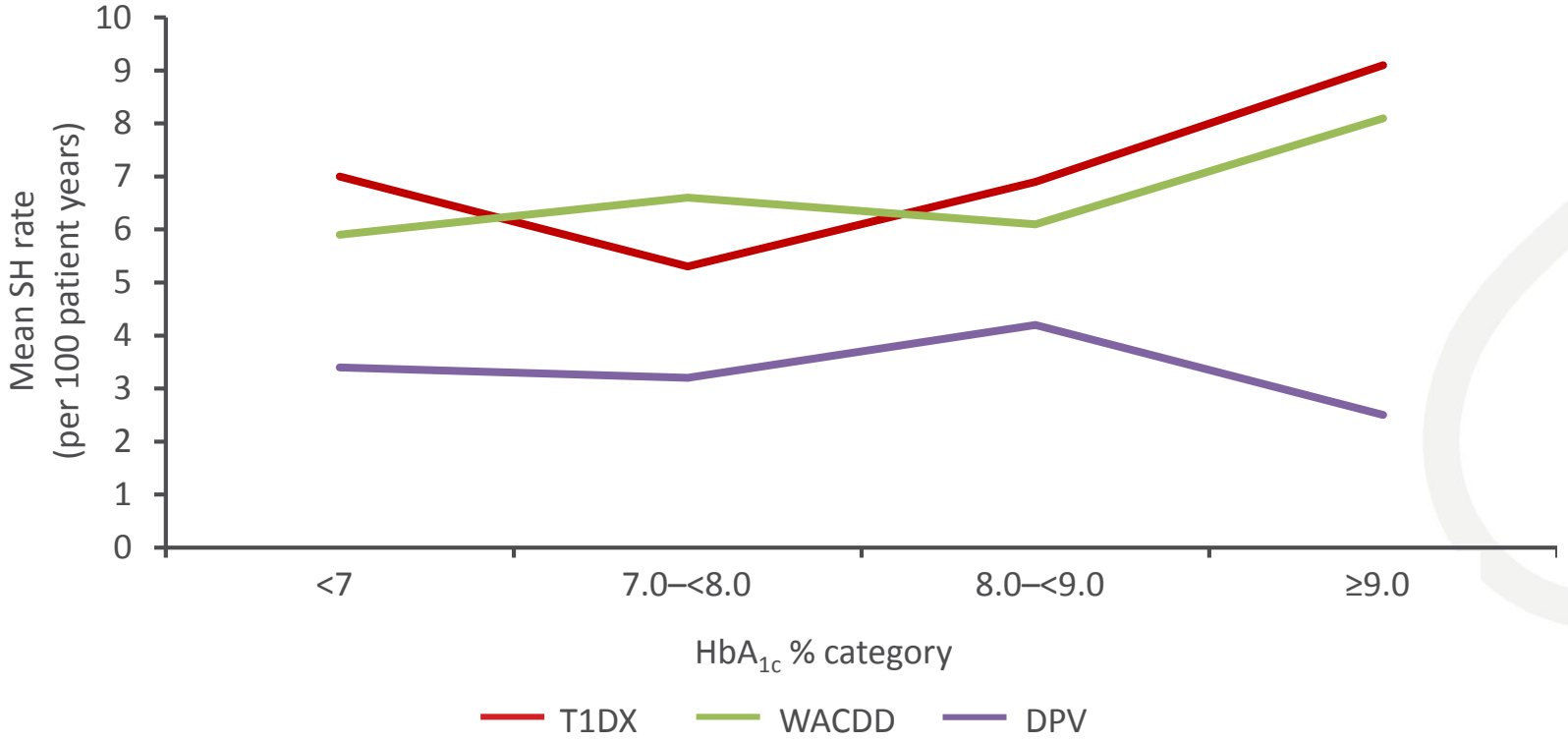
Juvenile Diabetes Research Foundation Continuous Glucose Monitoring Study Group. *Diabetes Care* 2010;33:1004–8.

Severe hypoglycaemia rate and HbA_{1c} % by registry and calendar year



DPV, Diabetes-Patienten-Verlaufsdokumentation; SH, severe hypoglycaemia; WACDD, Western Australian Children Diabetes Database.
Haynes, Holl et al, Unpublished

Severe hypoglycaemia rate and HbA_{1c} in 3 contemporary pediatric cohorts



DPV, Diabetes-Patienten-Verlaufsdokumentation; T1DX, Type 1 Diabetes Exchange; WACDD, Western Australian Children Diabetes Database.
Haynes A et al: *Pediatric Diabetes* 2017;18:643–50.

Contemporary pattern severe hypoglycaemia: contributors to changes

- Data: importance of recording hypoglycaemia
- Patient education
- Improved understanding of counter-regulation and hypoglycaemia precipitants
- More physiological insulin delivery through pumps and insulin analogues
- Increased glucose monitoring

Severe events: definitions in childhood

Historically

- Severe: coma and convulsion
- Moderate: hypoglycaemia associated with cognitive impairment requiring assistance from someone else for recovery

ISPAD Guidelines 2018, in press; Internaltional Hypoglycaemia Study Group. *Diabetes Care* 2017;40:155–7

Severe events: definitions in childhood

Historically

- Severe: coma and convulsion
- Moderate: hypoglycaemia associated with cognitive impairment requiring assistance from someone else for recovery

ISPAD 2018 guidelines

- Severe: event with severe cognitive impairment requiring external assistance by another person to actively take corrective action
- Severe hypoglycaemic coma: event associated with seizure or loss of consciousness

ISPAD Guidelines 2018, in press; Internaltional Hypoglycaemia Study Group. *Diabetes Care* 2017;40:155–7

Impact of hypoglycaemia among young people

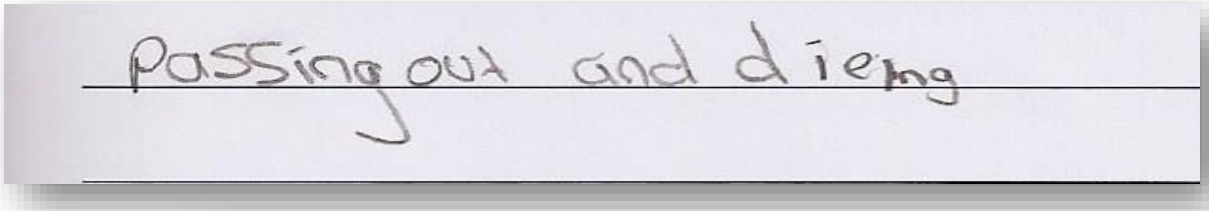
Short-term

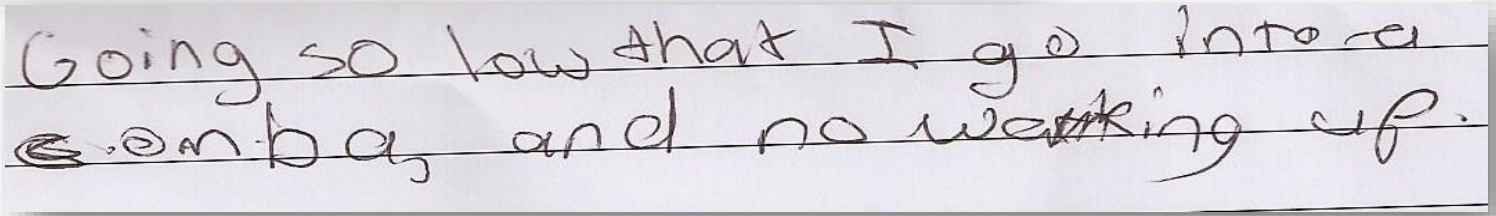
- Unpleasant symptoms
- Mood and behaviour changes
- Social embarrassment
- Cognitive deterioration
  - Driving
  - Work performance
  - School performance
  - Sport
- Accidents
- Seizure
- Death

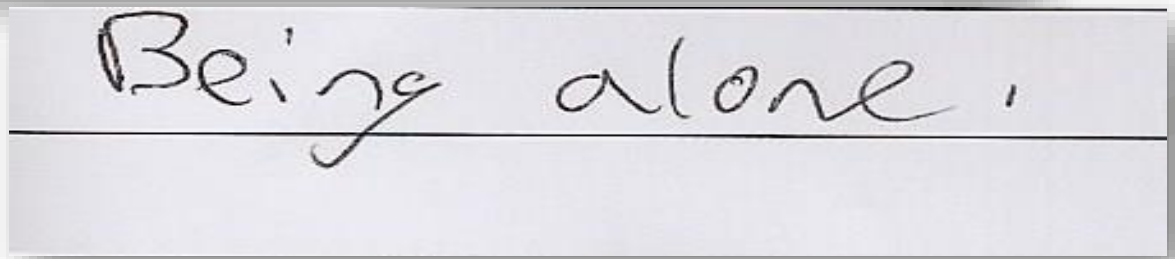
Long-term

- Fear of hypoglycaemia
- Reduced Quality of Life and family stress
- Weight gain
- Reduced physical activity
- Restrictions on employment
- Driving licensing restrictions
- Personal relationships impaired
- Brain development concerns

What are the main concerns about having hypoglycaemia







Hypoglycaemia: the child's perspective

- Unpleasant symptoms
- Embarrassment
- Fear of death
- Fear of unknown
- Concern about hyperglycaemia
- Loss of function, concentration

Johnson SR et al *Diabetic Medicine* 2013;30:1126–31.

Case history

Patient characteristics

- 10 years old, female
- Type 1 diabetes for 12 months
- MDI therapy
- HbA_{1c} 6.7%

im, intramuscular; MDI, multiple daily injection.

Case history

Patient characteristics

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- Type 1 diabetes for 12 months
- MDI therapy
- HbA_{1c} 6.7%

- Nocturnal seizure at 2 am, treated with im glucagon
- Previous day at the beach on holiday

im, intramuscular; MDI, multiple daily injection.

Case history

Patient characteristics

- 10 years old, female
- Type 1 diabetes for 12 months
- MDI therapy
- HbA_{1c} 6.7%

- Nocturnal seizure at 2 am, treated with im glucagon
- Previous day at the beach on holiday

- 2nd seizure 3 months later
- No obvious clinical predisposing factors

im, intramuscular; MDI, multiple daily injection.

Clinical factors associated with hypoglycaemia

Precipitants	Risk factors	Co-morbidities
Excess insulin	Impaired hypoglycaemia awareness	Celiac disease
Less food	Recurrent hypoglycaemia	Addison's disease
Exercise	Longer duration of T1D	Hypothyroidism
Sleep		Psychological distress
Alcohol ingestion		

ISPAD Guidelines 2018, in press

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Sleep		Psychological distress
Alcohol ingestion		

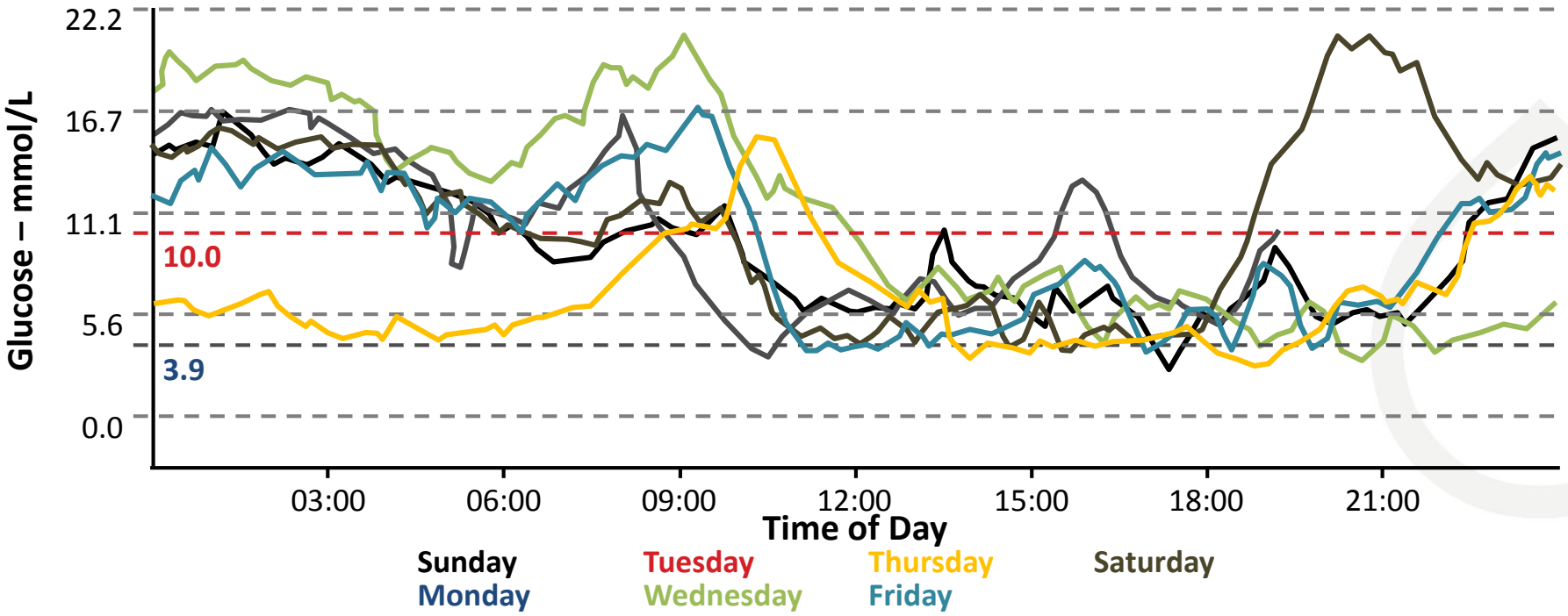
ISPAD Guidelines 2018, in press

Case history continued

At the next clinic visit 3 months later:

- HbA_{1c} 8.6%
- No further severe events

Fear of hypoglycaemia can be a major obstacle to improving glycaemic control

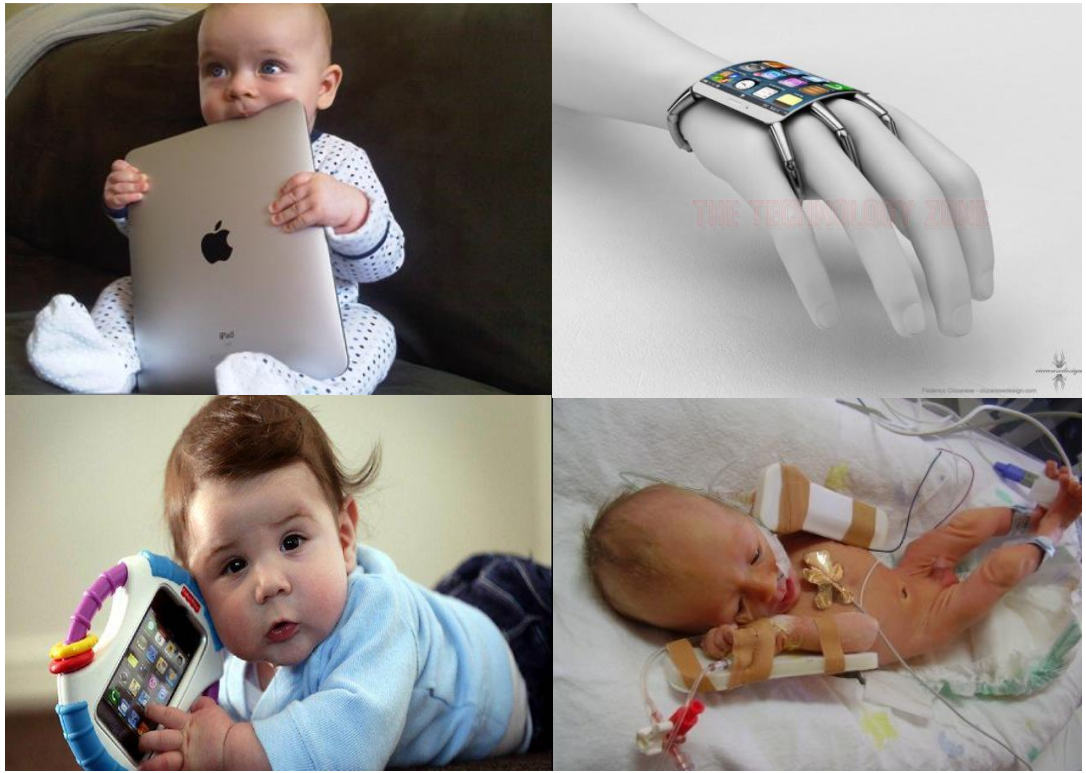


Fear of hypoglycaemia can be a major obstacle to improving glycaemic control

Excessive fear leading to inappropriate management:

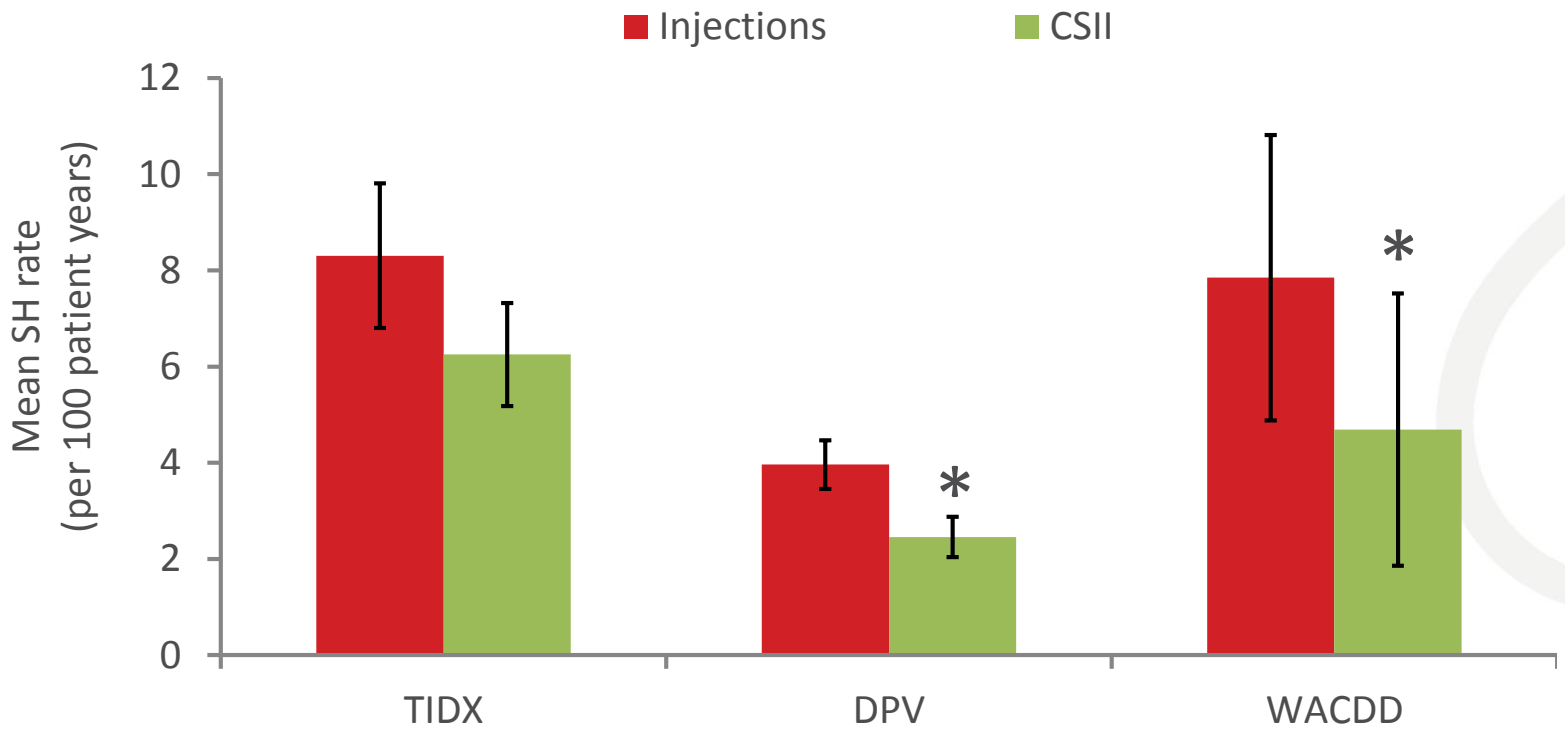
- Often makes child eat a large snack at bedtime: 13%
- Often avoids leaving child alone (age >13 years): 11%

Role and limitations of technology in children



- Children and technology
- Parents early adopters
- Must be practical
- Unexpected consequences of uses

Severe hypoglycaemia rate is lower with a CSII regimen



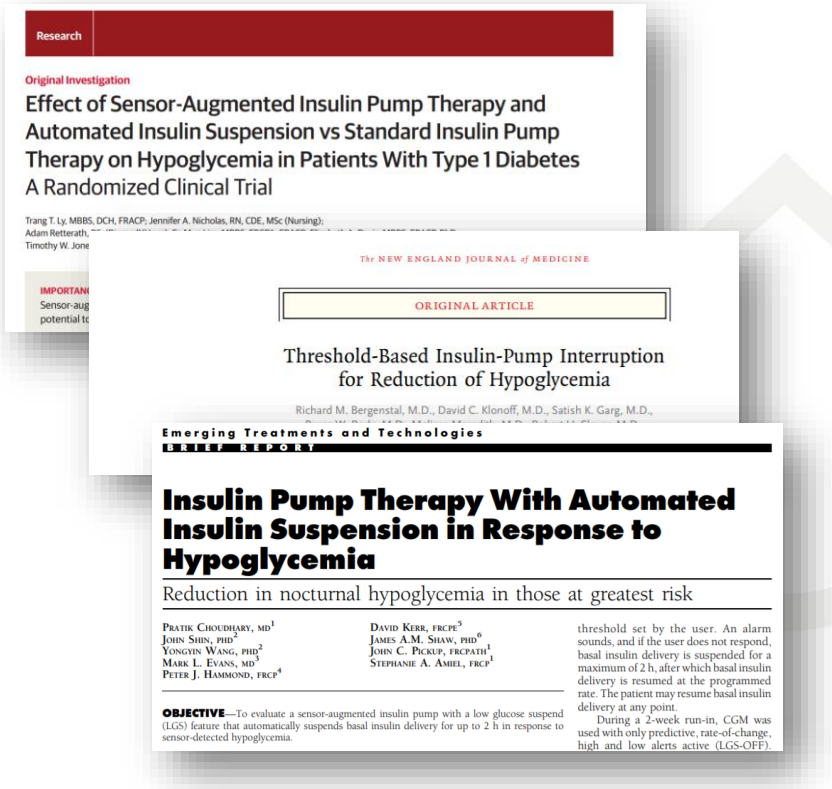
*p<0.05.

CSII, continuous subcutaneous insulin infusion; DPV, Diabetes-Patienten-Verlaufsdokumentation; SH, severe hypoglycaemia; T1DX, Type 1 Diabetes Exchange; WACDD, Western Australian Children Diabetes Database.

Haynes A et al: *Pediatric Diabetes*. 2016;18:643–50.

CGM with automated suspension with hypoglycaemia

Severe hypoglycemia	Insulin pump (N=49)	Sensor-augmented pump with LGS (N=46)
Baseline: actual event rate in preceding 6 months	5	6
Baseline: rate per 100 patient-years	25.5 (9.4, 55.6)	22.0 (7.1, 51.3)
Endpoint: actual event rate in preceding 6 months	6	0
Endpoint: rate per 100 patient-years	26.7 (5.5, 77.9)	0 (0, 29.23)
Incident rate difference from baseline to endpoint		17.8 (3.1, 32.4)
p-value		0.019


Research

Original Investigation

Effect of Sensor-Augmented Insulin Pump Therapy and Automated Insulin Suspension vs Standard Insulin Pump Therapy on Hypoglycemia in Patients With Type 1 Diabetes
A Randomized Clinical Trial

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Threshold-Based Insulin-Pump Interruption for Reduction of Hypoglycemia

Emerging Treatments and Technologies

BRIEF REPORT

Insulin Pump Therapy With Automated Insulin Suspension in Response to Hypoglycemia

Reduction in nocturnal hypoglycemia in those at greatest risk

PRATIK CHOUDHARY, MD[1] JOHN SHIN, PHD[2] YONGYIN WANG, PHD[2] MARK L. EVANS, MD[3] PETER J. HAMMOND, FRCP[4] DAVID KERR, FRCPE[5] JAMES A.M. SHAW, PHD[6] JOHN C. PICKUP, FRCPATH[1] STEPHANIE A. AMIEL, FRCP[1]

OBJECTIVE—To evaluate a sensor-augmented insulin pump with a low glucose suspend (LGS) feature that automatically suspends basal insulin delivery for up to 2 h in response to sensor-detected hypoglycemia.

threshold set by the user. An alarm sounds, and if the user does not respond, basal insulin delivery is suspended for a maximum of 2 h, after which basal insulin delivery is resumed at the programmed rate. The patient may resume basal insulin delivery at any point.

During a 2-week run-in, CGM was used with only predictive, rate-of-change, high and low alerts active (LGS-OFF).

CGM, continuous glucose monitoring; LGS, low glucose suspend.

Ly TT et al. *J Am Med Assoc* 2013;310:1240–7; Choudary P et al. *Diabetes Care* 2011;34:2023–5; Bergenstal RM et al. *N Engl J Med* 2013;369:224–32.

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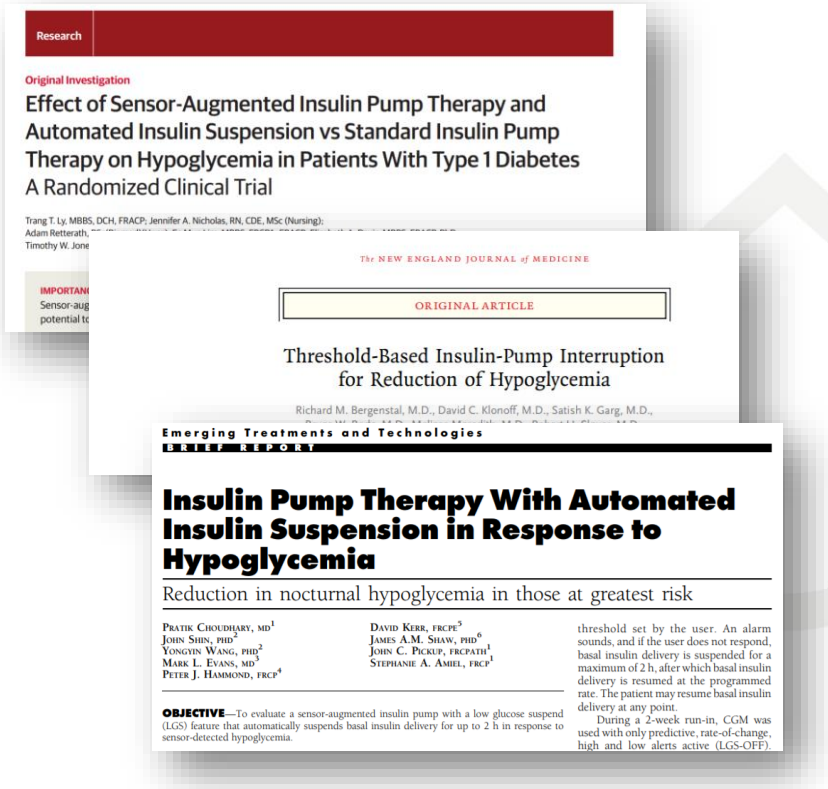

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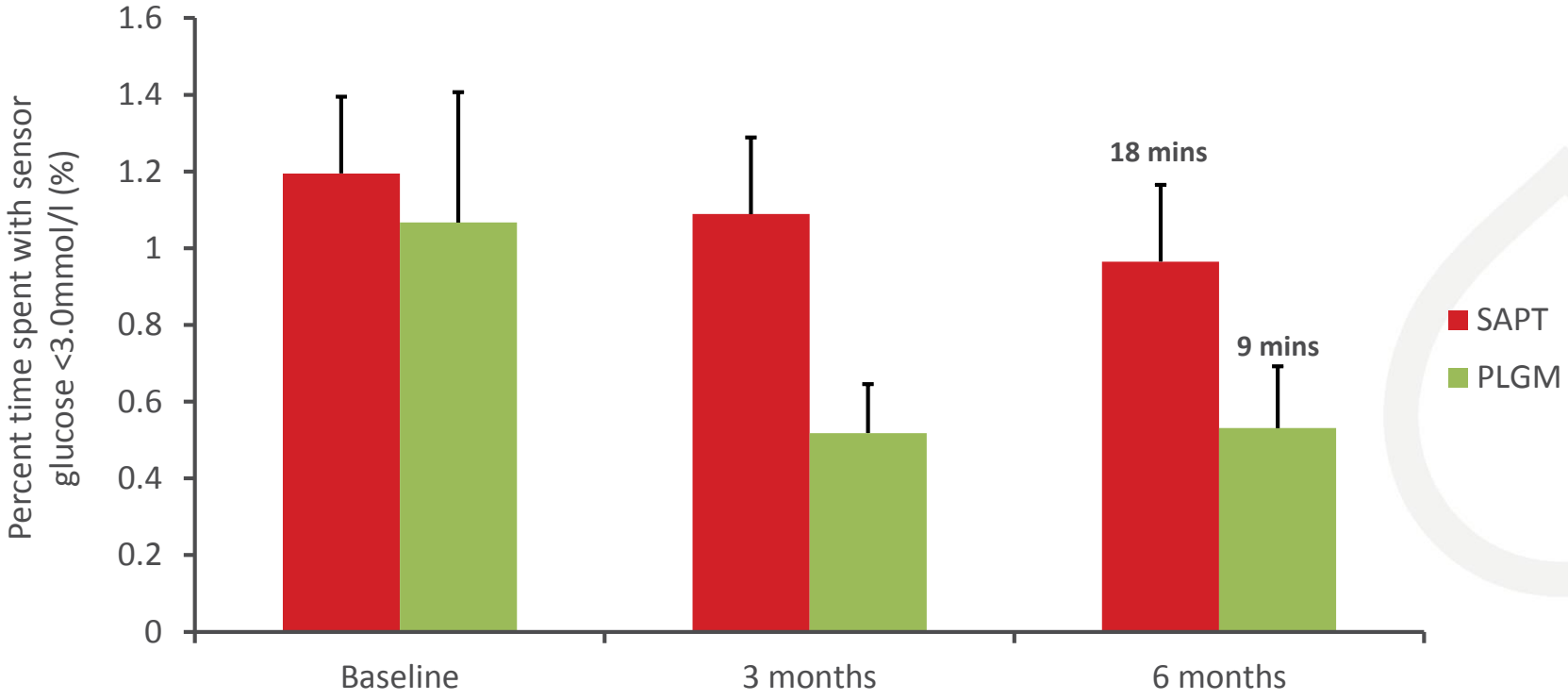
Reduction in hypoglycaemia with predictive suspension in adolescents: an RCT



PLGM, predictive low-glucose management; SAPT, sensor-augmented pump therapy.
Abraham MB et al. *Diabetes Care* 2018;41:303–10.

The potential role for technology in fear of hypoglycaemia

- Most studies have focused on glycaemic outcomes with technology
- The burden and fear of hypoglycaemia are key factors limiting optimal glycaemic control
- **Technological advances have the potential to reduce this burden**

Does real-time CGM with remote monitoring reduce hypoglycaemia fear and improve quality of life?

- Children with T1D, <12 years old
- Psychosocial measures primary outcome

RT CGM, real-time continuous glucose monitoring.

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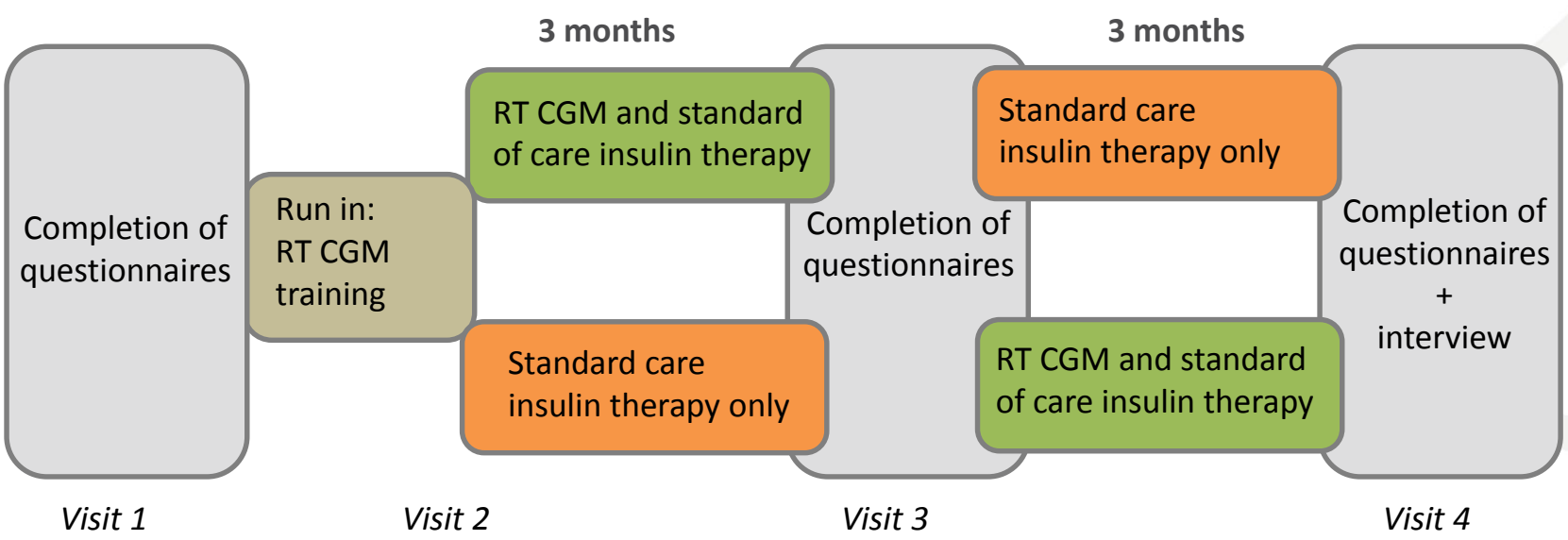
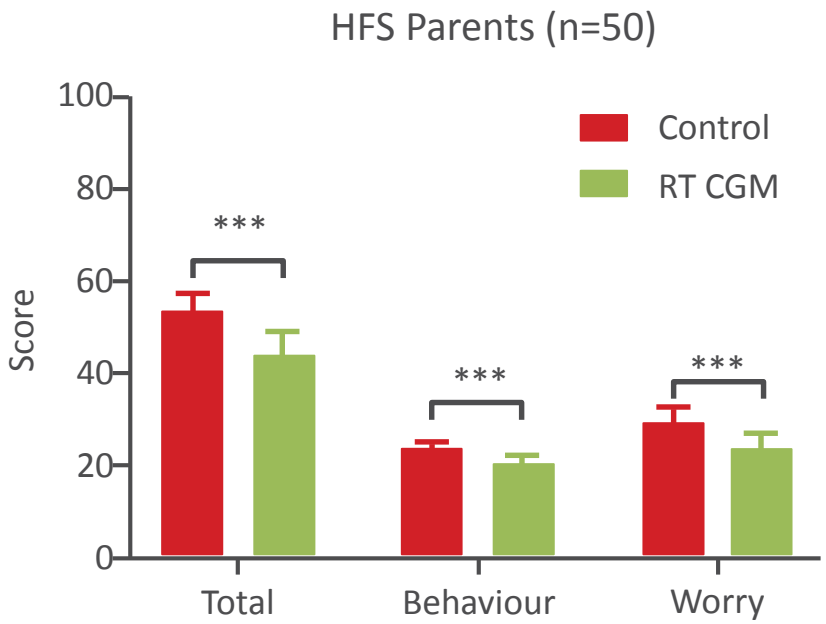
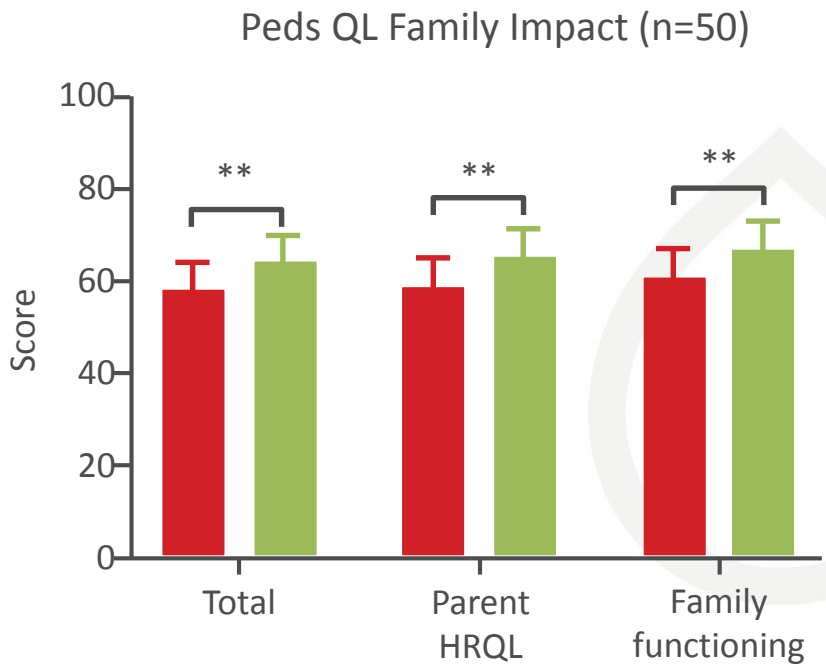


RT CGM, real-time continuous glucose monitoring.

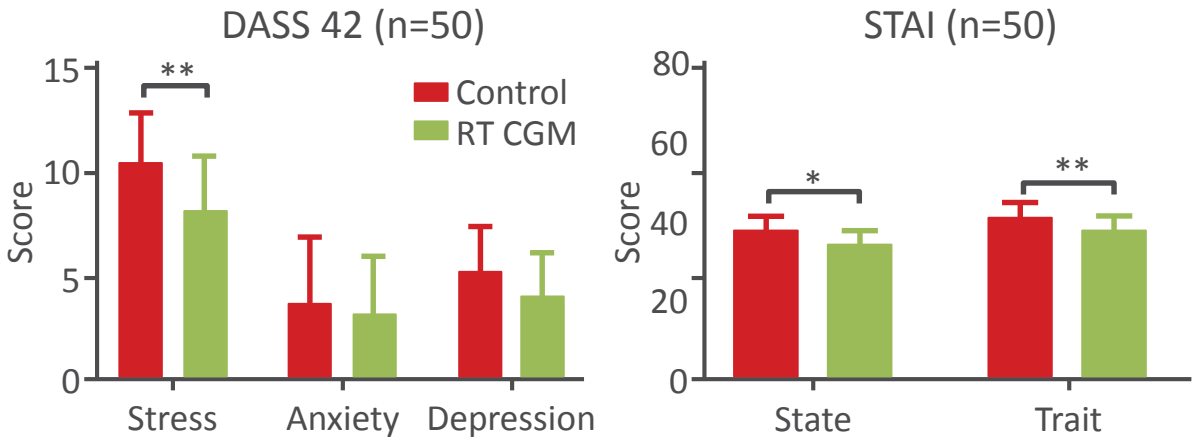
Reduced fear of hypoglycaemia, improved family functioning and parent HRQL





**p<0.01; ***p<0.001.
HRQL, health-related quality of life; RT CGM, real-time continuous glucose monitoring.
Burckhardt M et al, *Diabetes Care* (in press).

Less parental stress and anxiety leads to better sleep



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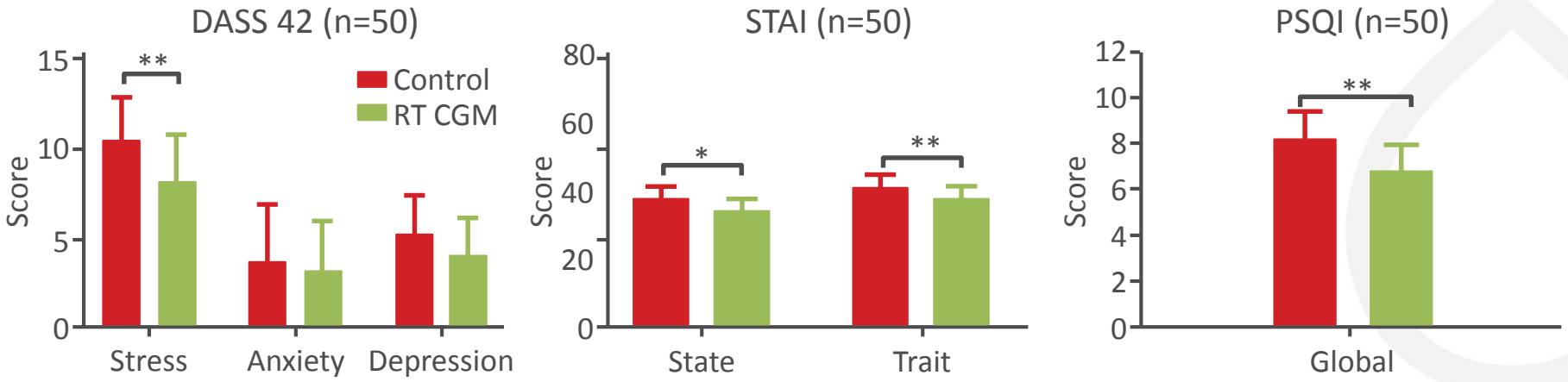

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Summary

Children are not just small adults and go through stages of development

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Hypoglycaemia and fear of hypoglycaemia have a major impact on diabetes care, the child and the family

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Children are not just small adults and go through stages of development

Hypoglycaemia and fear of hypoglycaemia have a major impact on diabetes care, the child and the family

With education and applied knowledge, the incidence of hypoglycaemia can be reduced but not abolished

Technology offers further promise to reduce the incidence and impact of hypoglycaemia in the young

Remember, if you have questions for our speakers….

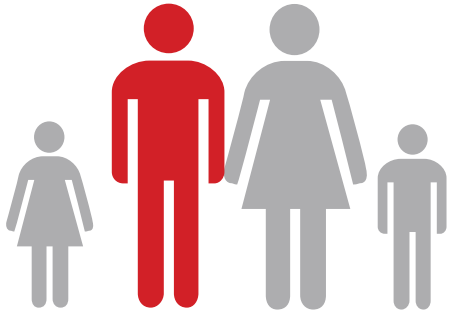
Raise your hand to have question cards collected

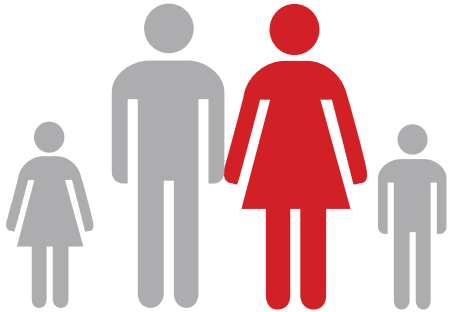
Questions will be answered during the panel discussion

Hypoglycaemia and the family

Stephanie Amiel, MD, FRCP
Professor of Diabetes Research
King's College London
London, United Kingdom

The person with diabetes = the family with diabetes





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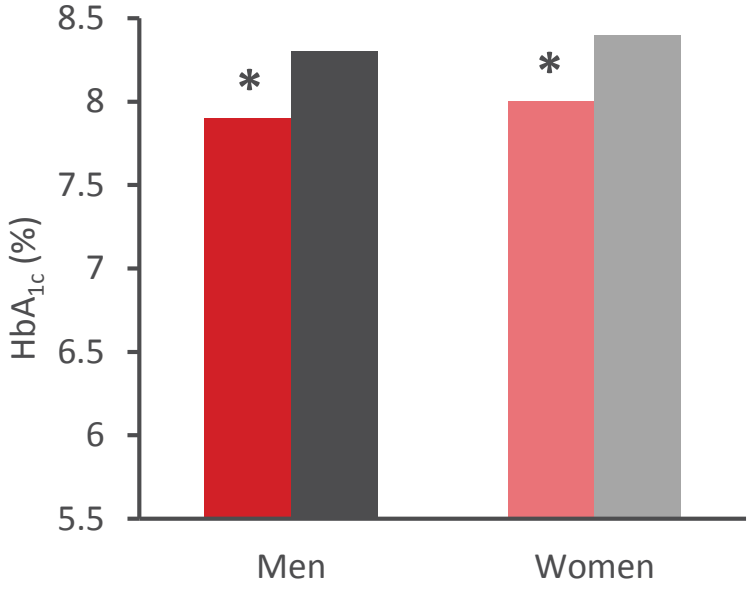
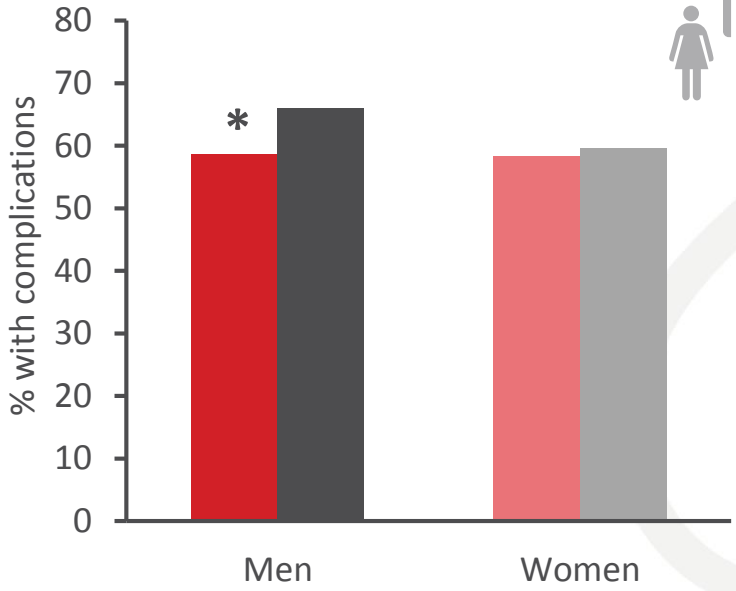
Having a partner improves diabetes outcomes



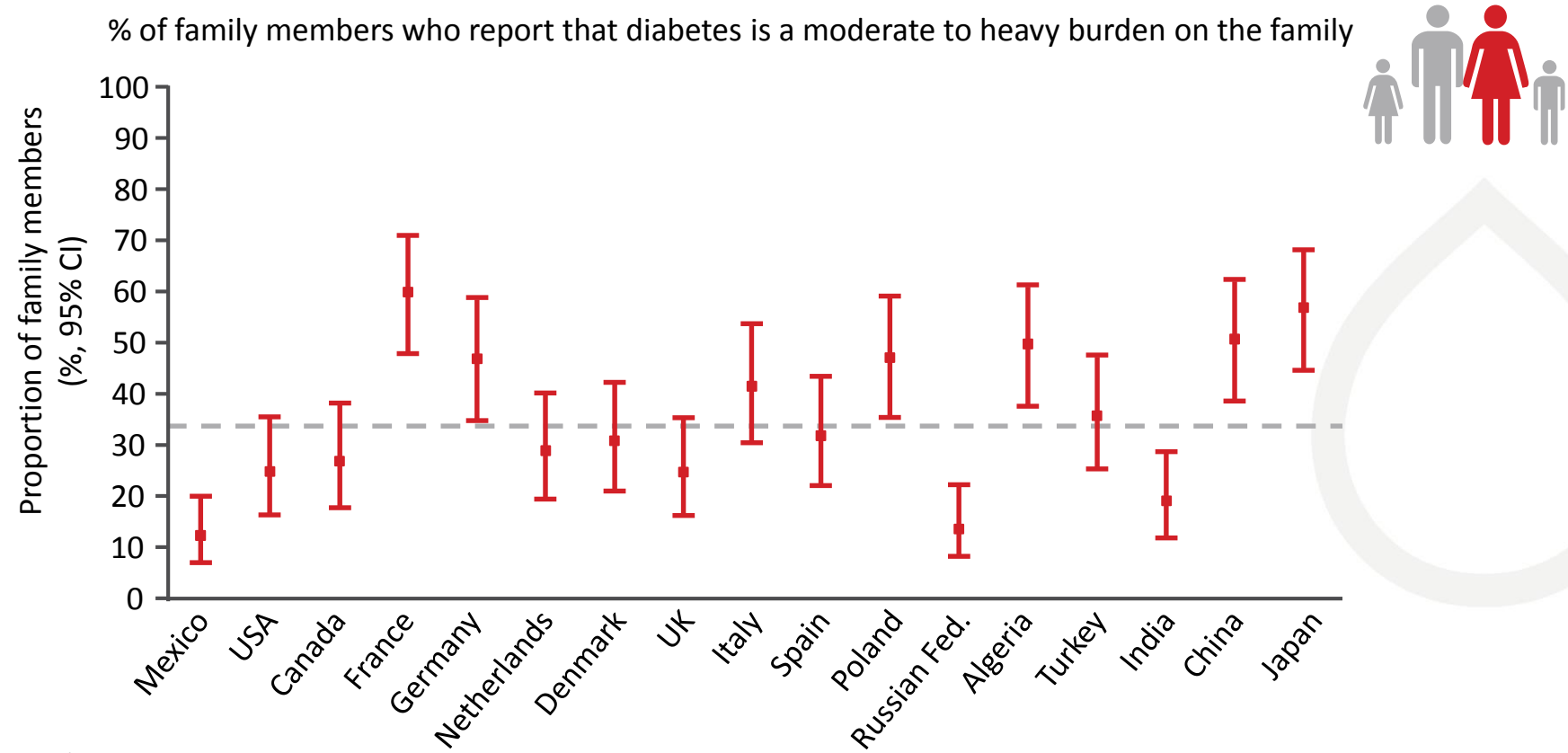


With partner

Without partner

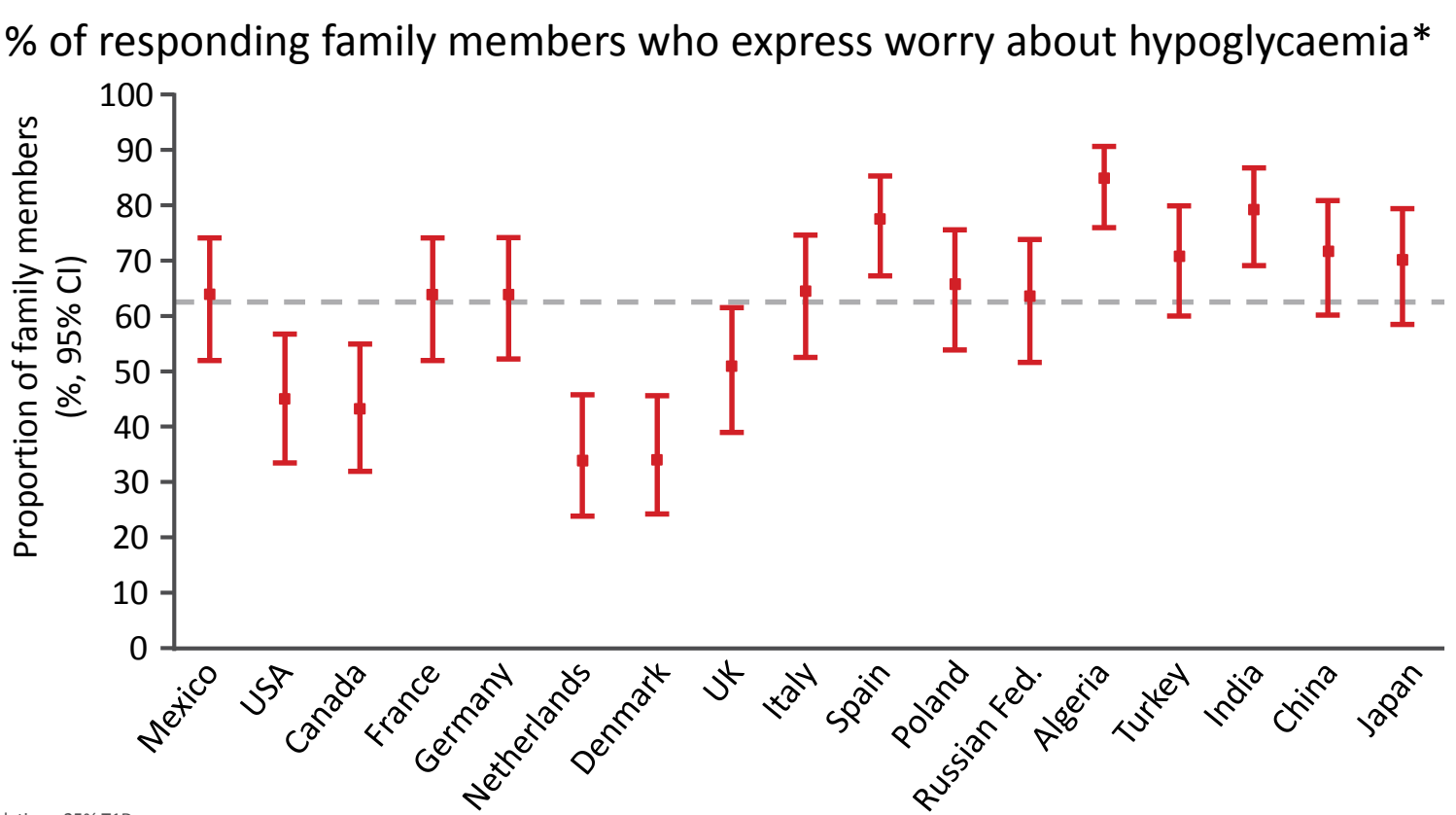
Cross sectional postal survey of 2419 adults (67%) attending specialist T1D services.
Joensen LE et al., *Diabetes Res Clin Pract*. 2013;101:278–85.

Adverse effects of hypoglycaemia on relatives



N=2057 relatives; 25% T1D.
CI, confidence interval; UK, United Kingdom; USA, United States of America.
DAWN2. Kovacs Burns K et al. *Diabet Med* 2013;30:778–88.

Not just type 1 diabetes…



2057 relatives, 25% T1D.

*"I am mainly or very worried about the risk of hypoglycaemic events in the individual with diabetes'. UK, United Kingdom; USA, United States of America.

DAWN2. Kovacs Burns K et al. *Diabet Med* 2013;30:778–88.

The worry relates to the hypoglycaemia

- 23 wives, 38 husbands
- Those whose partners had experienced recent severe hypoglycaemia showed:

NO difference in

- Depression
- Anxiety
- Marital conflict

MORE

- Fear of hypoglycaemia
- Marital conflict about diabetes management
- Sleep disturbances caused by hypoglycaemia

Gonder-Frederick L et al. *Diabetes Care* 1997;20:1543–6.

Scale for measuring diabetes distress in relatives of adults with T1D

Four types of distress:

Management

Role

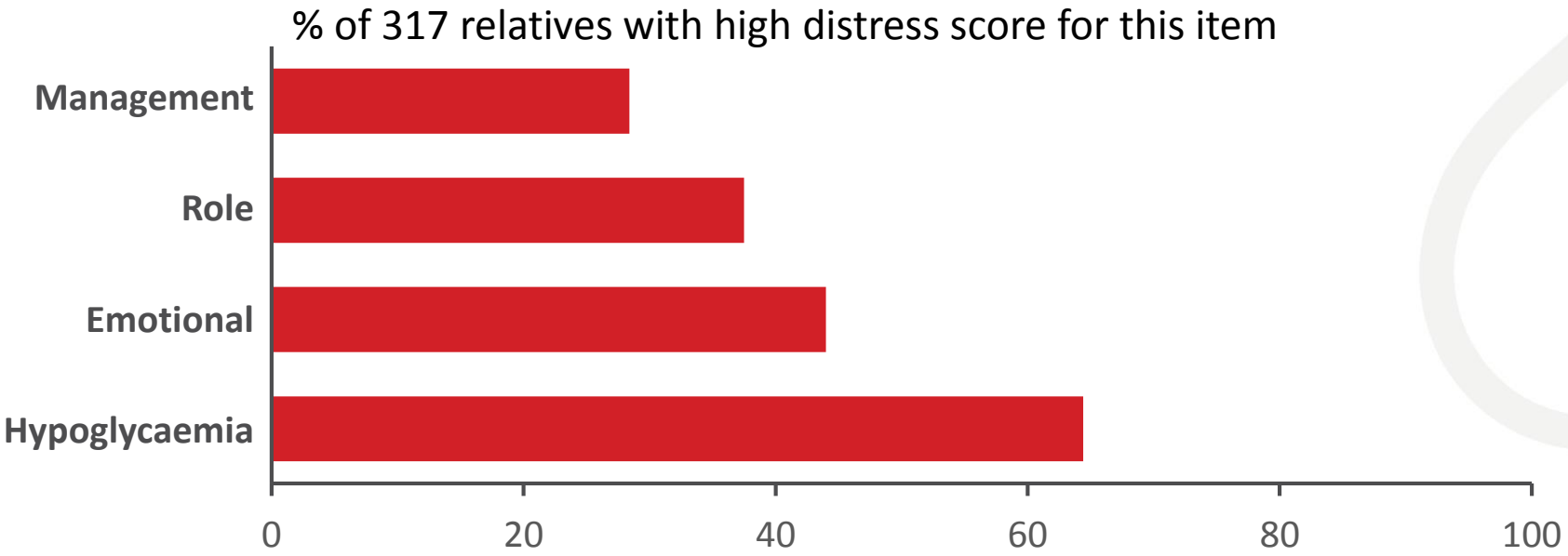
Emotional

Hypoglycaemia

Polonsky WH et al. *Diabetes Technol Ther* 2016;18:292–7.

Scale for measuring diabetes distress in relatives of adults with T1D

Four types of distress:

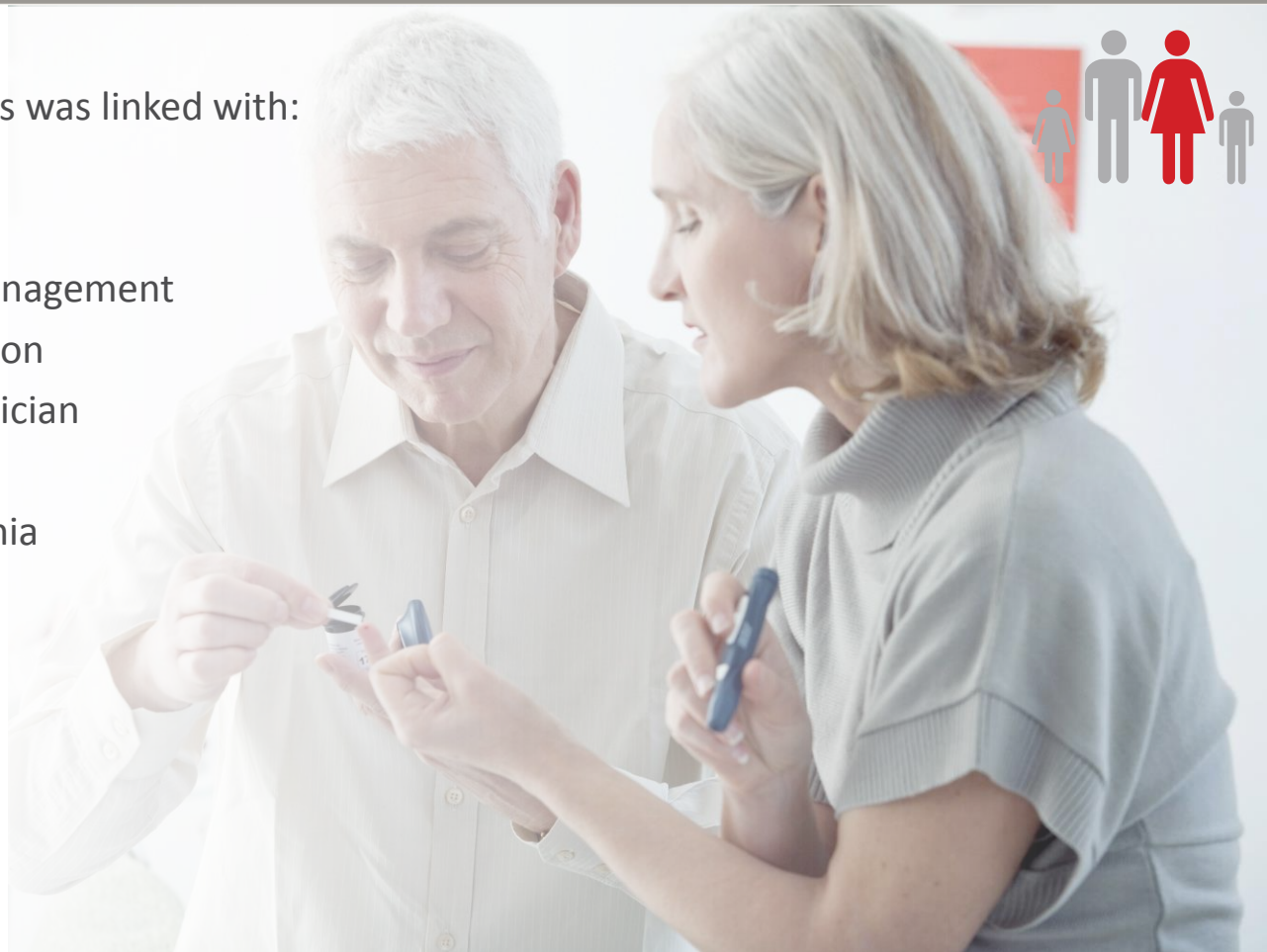


Polonsky WH et al. *Diabetes Technol Ther* 2016;18:292–7.

Diabetes distress in partners of adults with T1D

Greater partner diabetes distress was linked with:

- Younger age
- Female gender
- Involvement in the PWD management
- Lower relationship satisfaction
- Less trust in the PWD's physician
- Higher HbA_{1c}
- More frequent hypoglycaemia



PWD, person with diabetes.

Polonsky WH et al. *Diabetes Technol Ther* 2016;18:292–7.

Hypoglycaemia and the family

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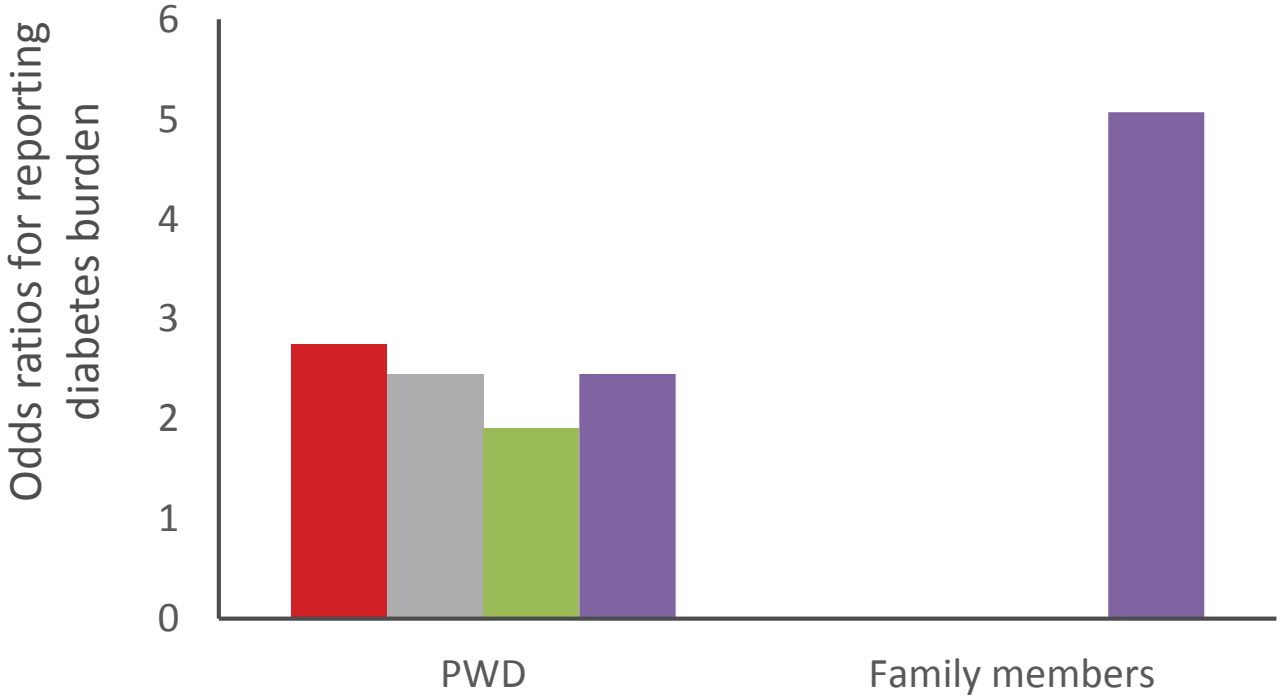
Impact of hypoglycaemia on diabetes burden



DAWN2 in the Netherlands
N = 412 PWD, N = 86 family members
NSH, non-severe hypoglycaemia; PWD, persons with diabetes; SH, severe hypoglycaemia.
Nefs G and Pouwer F. *BMC Public Health* 2018;18:156.

The relatives report more SH……

	PWD	Partner	
No. of SH in last year	1.6	2.7	<0.001
HA	37%	35%	
IAH	63%	65%	

HA, hypoglycaemia awareness; IAH, impaired awareness of hypoglycaemia; SH, severe hypoglycaemia.

Relatives of people with problematic hypoglycaemia

- Fear and worry about safety
- Physical and emotional impact of caring for a person with HU
  - Exhaustion
    - Disrupted sleep
  - Neglecting one's own health and social needs
  - Resentment and ambivalence
    - Used as a safety net
- Education, information, and support needs

> Being very careful not to let… grab me. … strength is huge at that point… I do get physically afraid. I won't let… hold my hand

HU, hypoglycaemia unawareness.

Lawton J et al *Diabetes Care* 2014;37:109–15.

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I just don't have a social life

HU, hypoglycaemia unawareness.

Lawton J et al *Diabetes Care* 2014;37:109–15.

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> As soon as we get home and… relaxes,… nearly always has a hypo….

HU, hypoglycaemia unawareness.
Lawton J et al *Diabetes Care* 2014;37:109–15.

Children of adults with diabetes

Jacobson S and Wood F. *The Diabetes Educator* 2004; 30:820–6

Children of adults with diabetes

- 51 adults with diabetes, 22% T1D
- 15.7% reported child carers, age range 5 – 18 years
  - planning meals
  - drawing up or administering medications,
  - testing blood glucose
  - interpreting results
  - transporting

Jacobson S and Wood F. *The Diabetes Educator* 2004; 30:820–6

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Activity	Male	Female	Total	%
Provide juice or food if hypoglycaemic	12	23	35	68.6
Meal planning or preparation	8	19	27	52.9
Stay with adult at night or when ill	8	16	24	47.1
Promote activity	8	14	22	43.1
Draw up insulin, lay out medication	3	11	14	29.4
Check feet	7	8	15	27.5
Call to check on adult	5	8	13	25.5
Perform glucose testing	3	7	10	19.6
Provide transportation	6	3	9	17.6
Serve as interpreter (English/Spanish)	2	4	6	11.8
Give insulin injections	1	4	5	9.8

Jacobson S and Wood F. *The Diabetes Educator* 2004; 30:820–6

When the teenager has diabetes

- Personal distress*
- Teen management distress*
- Parent/teen relationship
- Healthcare team-related

*associated with hypoglycaemia.

Hessler D et al. *J Pediatric Psych* 2016; 41:750–8.

When the child has diabetes

Impact of Fear of Hypoglycaemia in parents of young children:

- Experience of severe hypoglycaemia increases monitoring and fear
- Hypoglycaemia at night and in social situations more distressing
- Maternal depression and anxiety related to fear of hypoglycaemia

- Nocturnal monitoring
- Accepting or driving higher blood glucose

Barnard K et al. *BMC Pediatrics* 2010;10:50.

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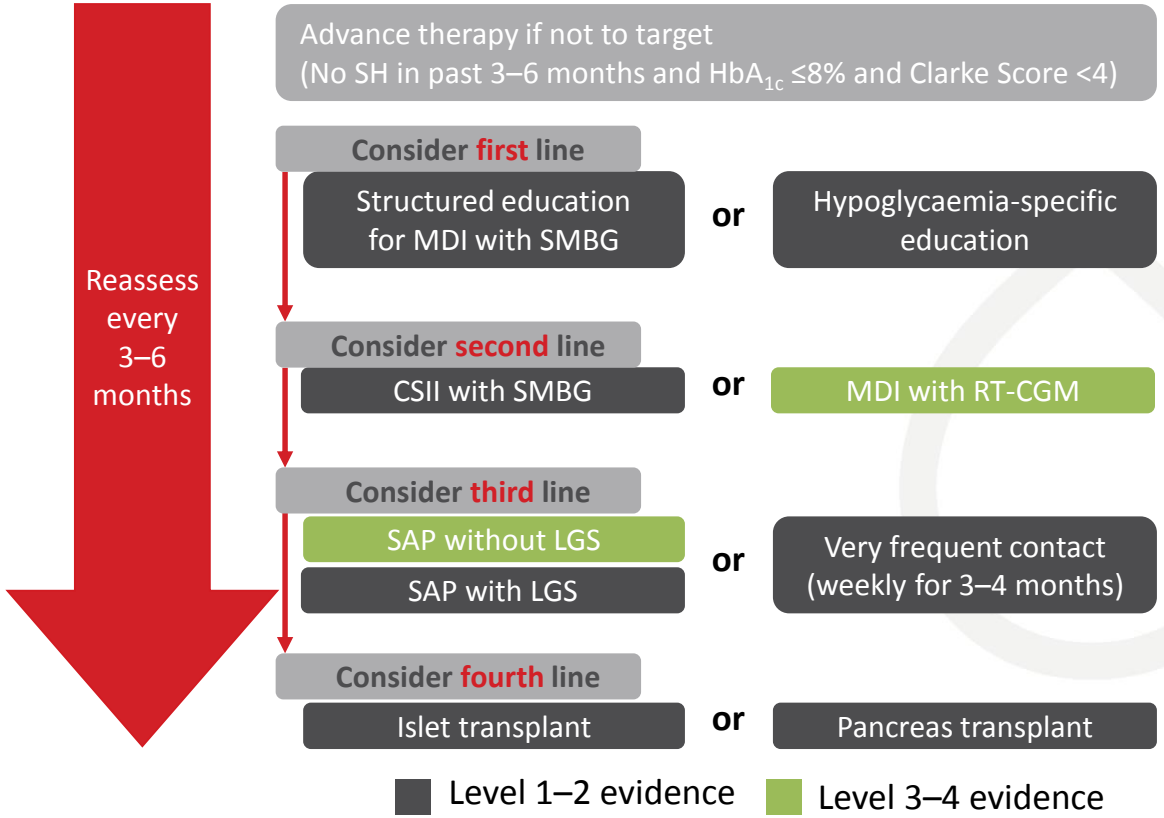
Helping the family with hypoglycaemia

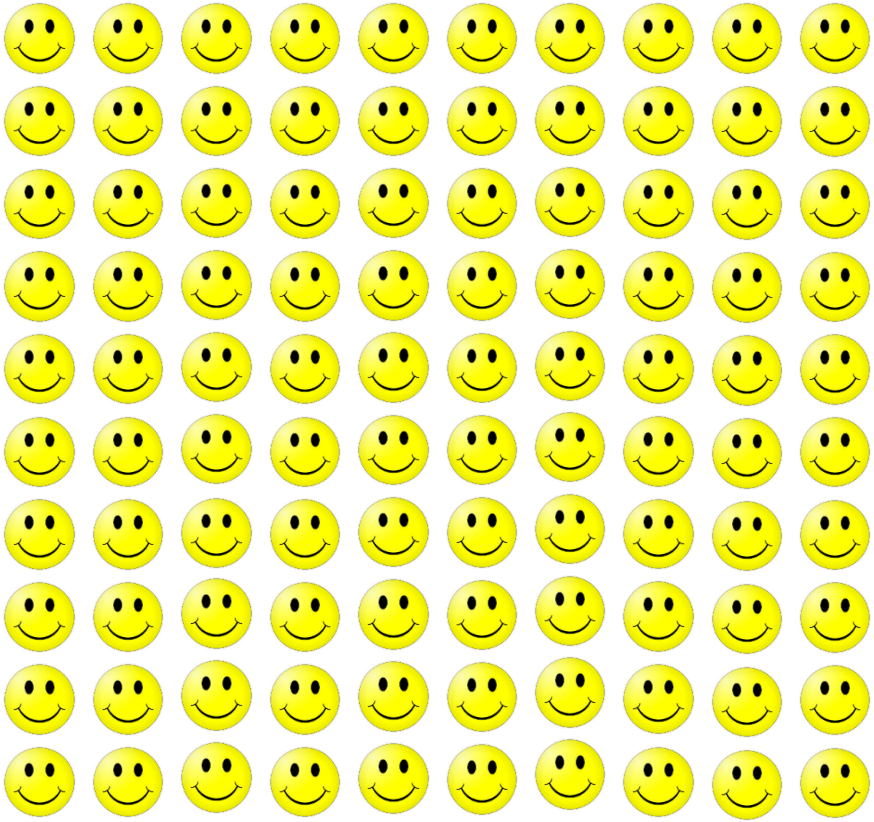
- The hypoglycaemia treatment pathway for the PWD
- Elimination of contributory health factors
- Structured education in flexible insulin therapy
- Technology
  - Pumps
  - CGM
  - Automated insulin adjustment algorithms
- Transplantation



CGM, continuous glucose monitoring; CSII, continuous subcutaneous insulin infusion; LGS, low glucose suspend; MDI, multiple daily injection; PWD, persons with diabetes; RT-CGM, real-time continuous glucose monitoring; SAP, sensor-augmented pump; SH, severe hypoglycaemia; SMBG, self-measured blood glucose..

Choudhary P et al. *Diabetes Care* 2015;38:1016–29.

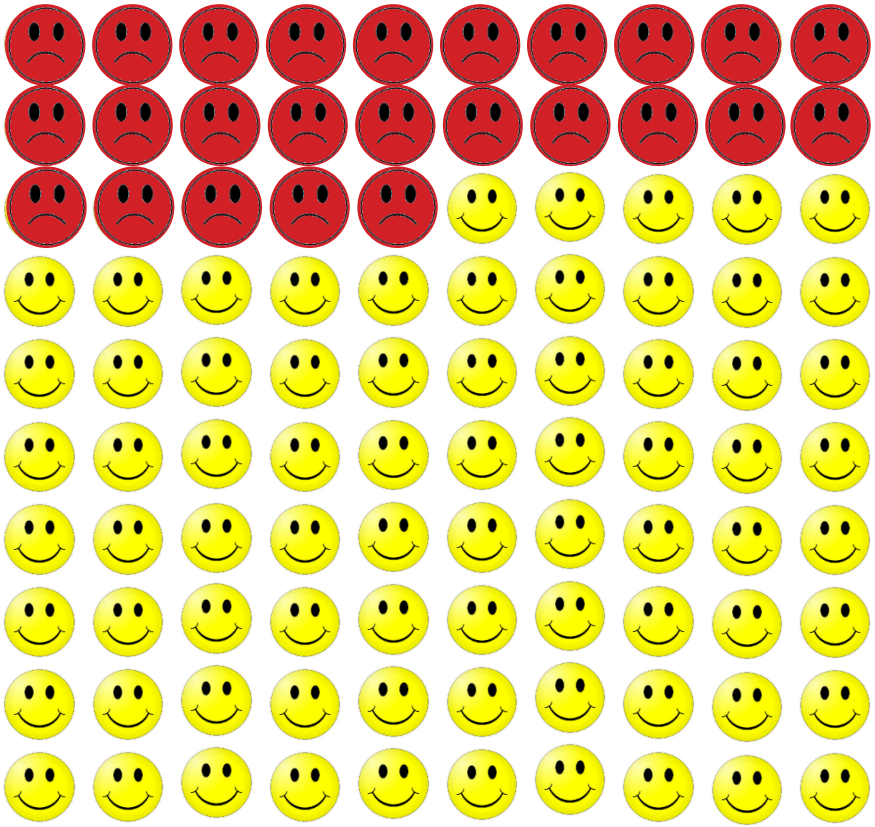
Psychological barriers to hypoglycaemia avoidance



SH risk	Concern
Low	

IAH, impaired awareness of hypoglycaemia; SH, severe hypoglycaemia.
Anderbro T et al. *Acta Diabetol* 2015;52:581–9; Naito et al., 2018 Poster session 80.

Psychological barriers to hypoglycaemia avoidance



SH risk **Concern**

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High

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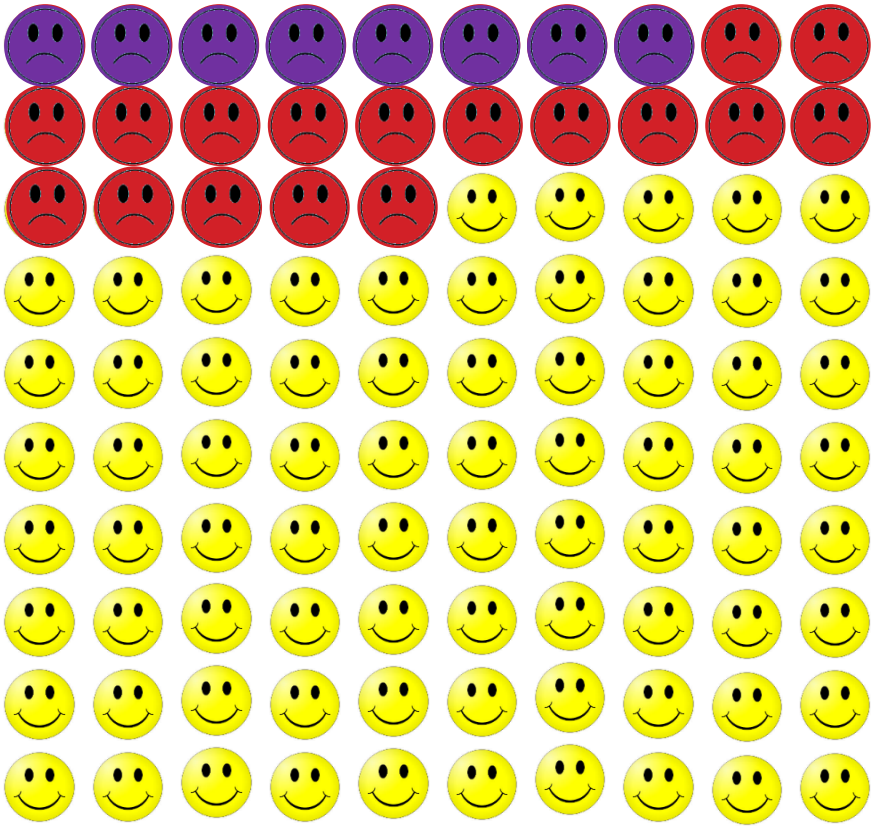
Anderbro T et al. *Acta Diabetol* 2015;52:581–9; Naito et al., 2018 Poster session 80.

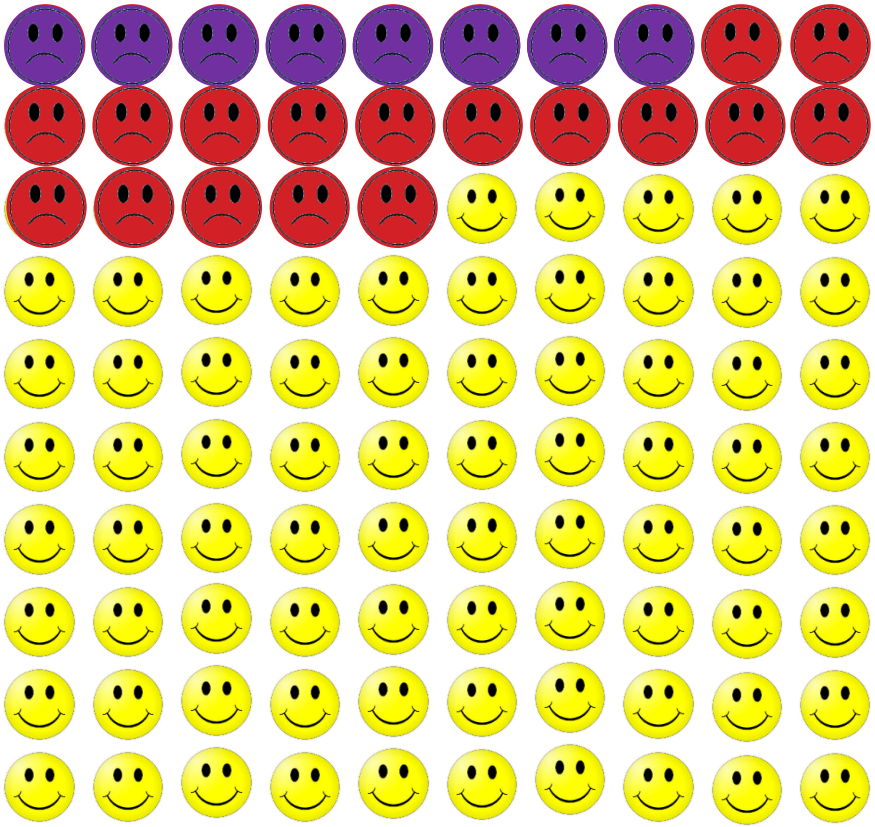
Psychological barriers to hypoglycaemia avoidance



	SH risk	Concern
Low		
High	High	
High	Low	

IAH, impaired awareness of hypoglycaemia; SH, severe hypoglycaemia.
Anderbro T et al. *Acta Diabetol* 2015;52:581–9; Naito et al., 2018 Poster session 80.

Psychological barriers to hypoglycaemia avoidance



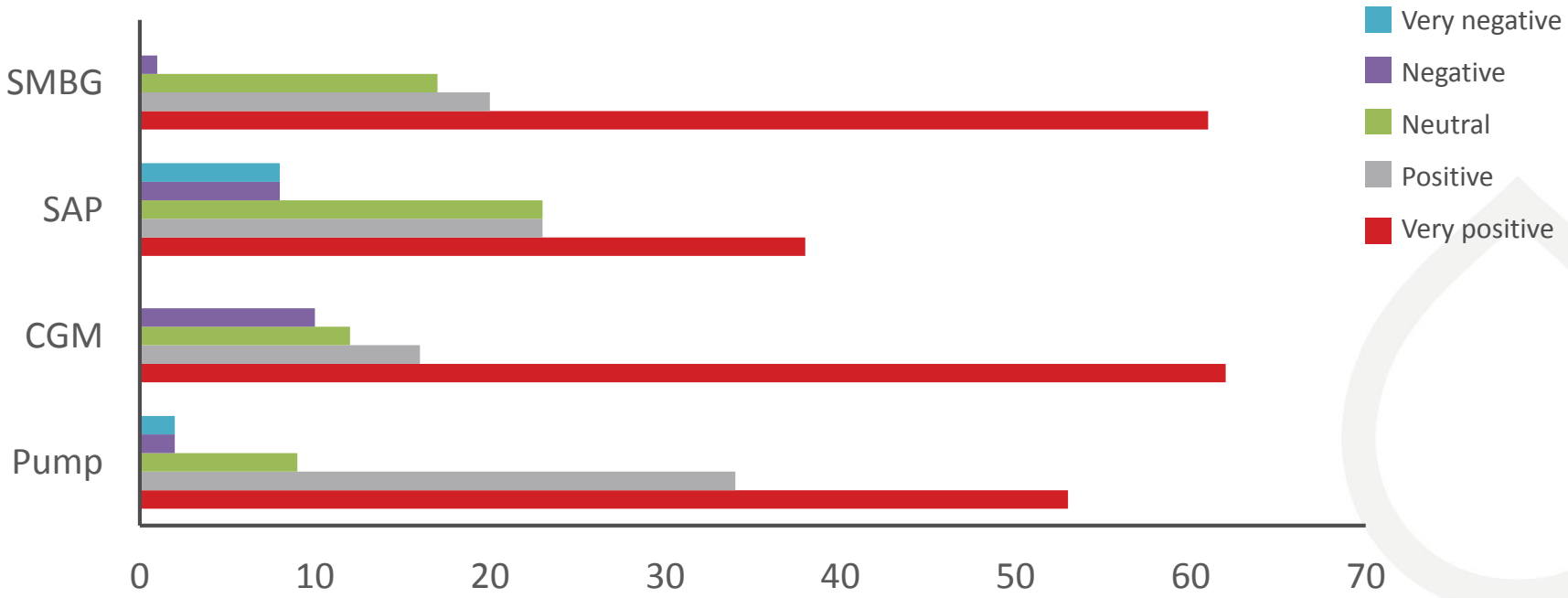
Attitudes to awareness	HA	IAH
Asymptomatic hypoglycaemia normalised	2 (0.25–3)	1 (0–3)
Hypoglycaemia concern minimized	2 (1–4)	4 (2–6)*
Hyperglycaemia avoidance prioritized	4 (3–5.75)	6 (4–7)*

IAH, impaired awareness of hypoglycaemia; SH, severe hypoglycaemia.
Anderbro T et al. *Acta Diabetol* 2015;52:581–9; Naito et al., 2018 Poster session 80.

Hypoglycaemia and the family

- Effect of hypoglycaemia on spouses
- Effect on other family members/caregivers
- Fear of hypoglycaemia and the family
- Strategies to mitigate deleterious effects
- Technology impact in families

Impact of technology for partner on spouse



Questionnaire study, 74 partners
CGM, continuous glucose monitoring; SAP, sensor-augmented pump; SMBG, self-measured blood glucose.
Barnard K et al. *J Diabetes Sci Technol* 2016;10:824–30.

Treatment and support

"Providers should consider an assessment of symptoms of diabetes distress, depression... including caregivers and family members in this assessment."

Young-Hyman D et al. *Diabetes Care* 2016;39:2126–40.

Treatment and support

"Providers should consider an assessment of symptoms of diabetes distress, depression... including caregivers and family members in this assessment."

Providers should consider including caregivers and family members

Young-Hyman D et al. *Diabetes Care* 2016;39:2126–40.

Concluding remarks

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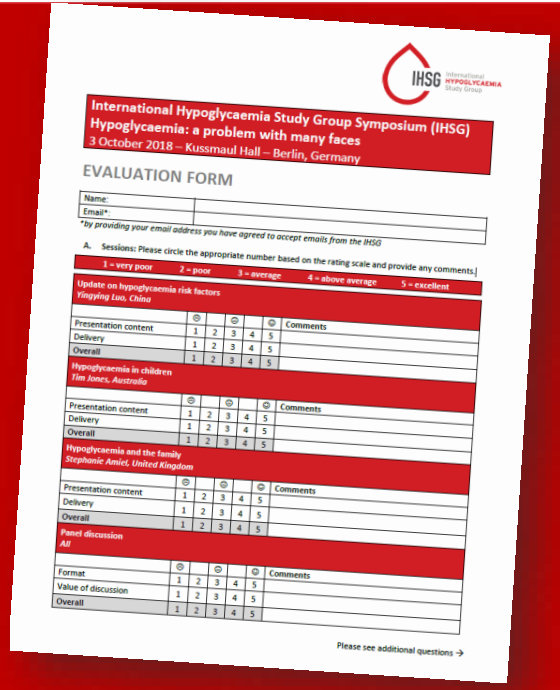

IHSG International HYPOGLYCAEMIA Study Group

International Hypoglycaemia Study Group Symposium (IHSG)
Hypoglycaemia: a problem with many faces
3 October 2018 – Kussmaul Hall – Berlin, Germany

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Update on hypoglycaemia risk factors
Yingying Luo, China

	☹		☺		☺	Comments
Presentation content	1	2	3	4	5	
Delivery	1	2	3	4	5	
Overall	1	2	3	4	5	

Hypoglycaemia in children
Tim Jones, Australia

	☹		☺		☺	Comments
Presentation content	1	2	3	4	5	
Delivery	1	2	3	4	5	
Overall	1	2	3	4	5	

Hypoglycaemia and the family
Stephanie Amiel, United Kingdom

	☹		☺		☺	Comments
Presentation content	1	2	3	4	5	
Delivery	1	2	3	4	5	
Overall	1	2	3	4	5	

Panel discussion
All

	☹		☺		☺	Comments
Format	1	2	3	4	5	
Value of discussion	1	2	3	4	5	
Overall	1	2	3	4	5	

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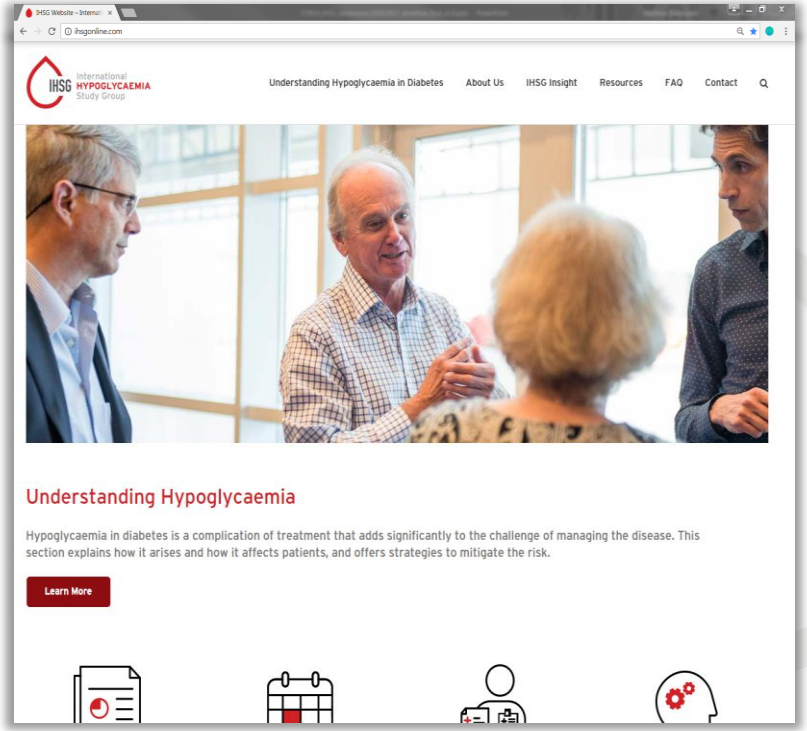

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A Symposium on the occasion of the 54th Annual Meeting of the European Association for the Study of Diabetes

3 October 2018

Berlin, Germany

Brought to you by members of the International Hypoglycaemia Study Group

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