TYPE 1 DIABETES AND DEMENTIA

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DISCLOSURES

- National Advisor NHS Engagement for Sanofi UK 4 days/week
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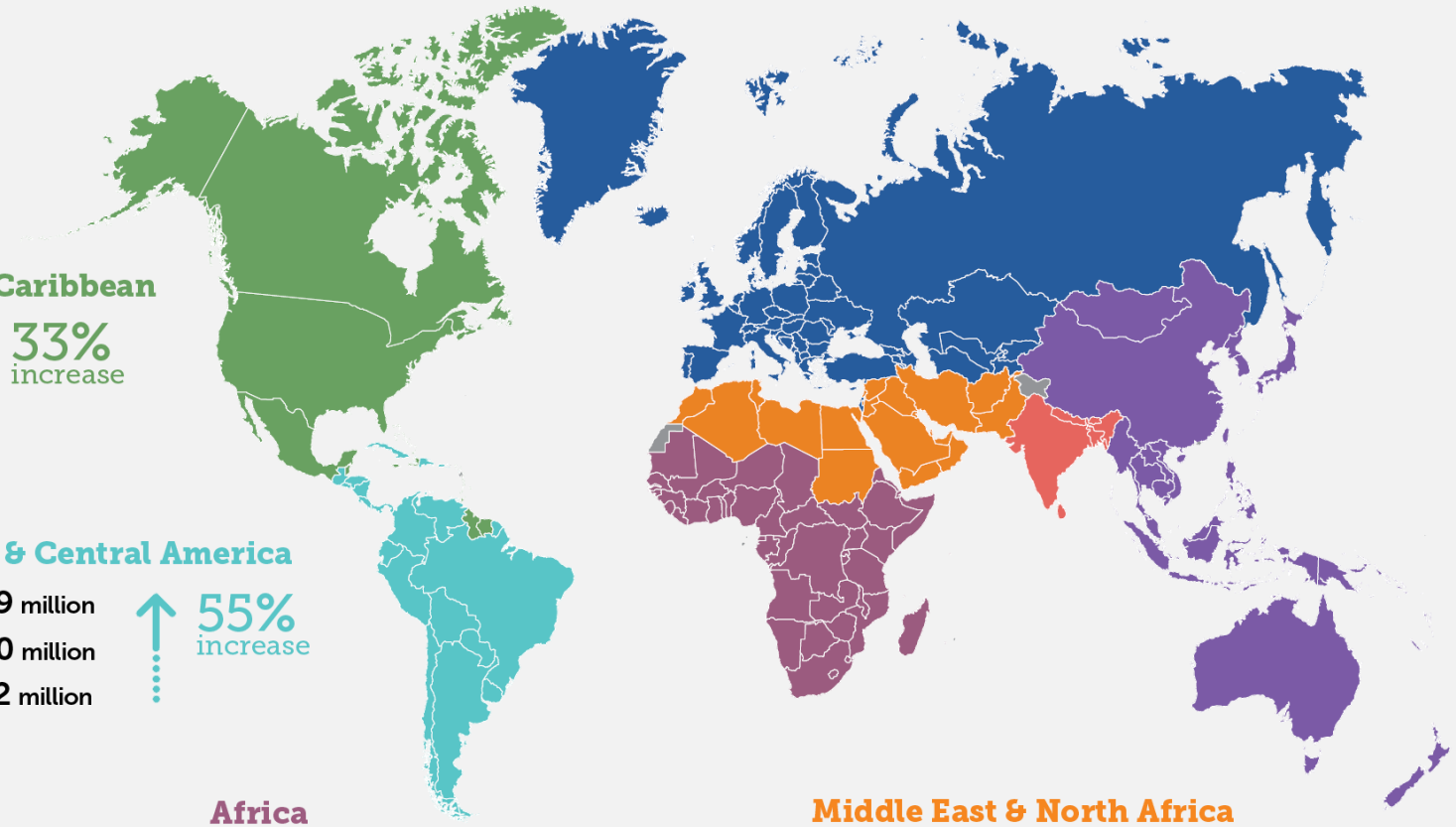
http://www.youtube.com/@GoggleDocs

Number of people (20-79 years) with diabetes globally and by IDF Region



North America & Caribbean
2045 63 million
2030 56 million
2019 48 million
33% increase

South & Central America
2045 49 million
2030 40 million
2019 32 million
55% increase

Africa
2045 47 million
2030 29 million
2019 19 million
143% increase

Middle East & North Africa
2045 108 million
2030 76 million
2019 55 million
96% increase

Europe
2045 68 million
2030 66 million
2019 59 million
15% increase

South-East Asia
2045 153 million
2030 115 million
2019 88 million
74% increase

Western Pacific
2045 212 million
2030 197 million
2019 163 million
31% increase

IDF World Atlas of Diabetes 9th Edition 2019

INTRODUCTION

In 2019, IDF estimates that:

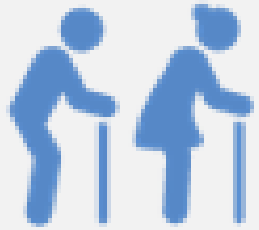
1 in 11 adults (20-79 years) has diabetes
463 million people

10% of global health expenditure is spent on diabetes
USD 760 billion

1,110,100 children and adolescents below 20 years have type 1 diabetes.

1 in 2 adults with diabetes are undiagnosed
232 million people

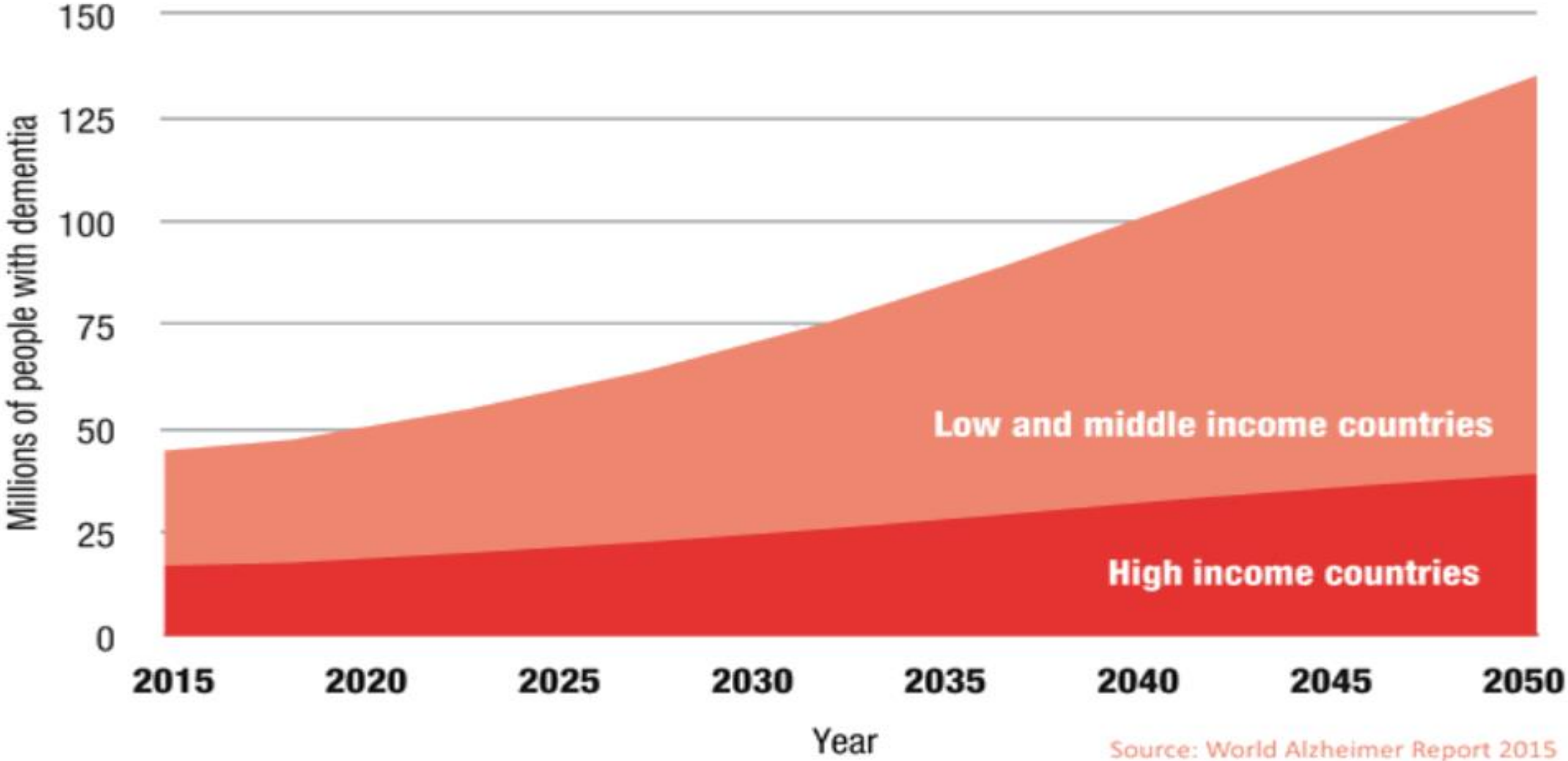
1 in 5 people with diabetes is above 65 years old
136 million people



in 6 live births
20 million) is affected
y hyperglycaemia
n pregnancy
4% of which is due to
estational diabetes

Over 3 in 4 people wit
diabetes live in low- a
middle-income countr

Number of people with dementia in low and middle income countries compared to high income countries



Source: World Alzheimer Report 2015

DIABETES AND DEMENTIA

- Epidemiological studies report up to 20% of people aged >60 years with type 2 diabetes may have prevalent dementia

- The incidence rate of dementia in people with type 2 diabetes can range from

  -83/10,000 person-years in those aged between 60-64 years

  -1000/10,000 person-years in those aged above 85 years

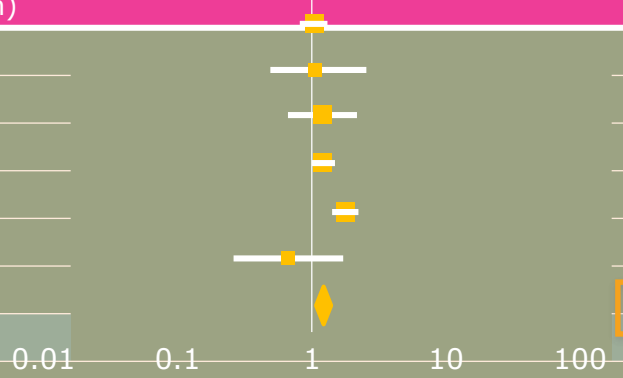
Bunn F, Burn AM, Goodman C, et al. Comorbidity and dementia: a scoping review of the literature. BMC medicine 2014; 12: 192.
Exalto LG, Biessels GJ, Karter AJ, et al. Risk score for prediction of 10 year dementia risk in individuals with type 2 diabetes: a cohort study. The lancet Diabetes & endocrinology 2013; 1(3): 183-90.

COGNITIVE DECLINE IN ELDERLY PATIENTS WITH DIABETES

When assessed by the Mini-Mental State Exam (MMSE) and the Digit Symbol Span tests (DSS), **diabetes increased the odds of cognitive decline 1.2-fold and 1.7-fold respectively**

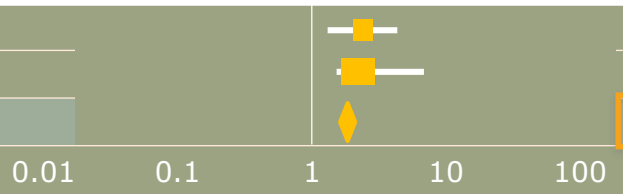
Cognitive decline as assessed by the MMSE

	DM (n)	No DM (n)	OR and 95% CI
Gregg et al	402	584	1.0 (0.8, 1.4)
Fontbonne et al	55	768	1.0 (0.5, 2.2)
Nguyen et al	347	1412	1.1 (0.9, 1.4)
Stewart et al	62	154	1.2 (0.9, 1.6)
Wu et al	585	1204	1.7 (1.2, 2.3)
Kanaya et al	118	632	0.7 (0.3, 1.7)
Total (95% CI)	**1569**	**10014**	**1.2 (1.05, 1.4)**



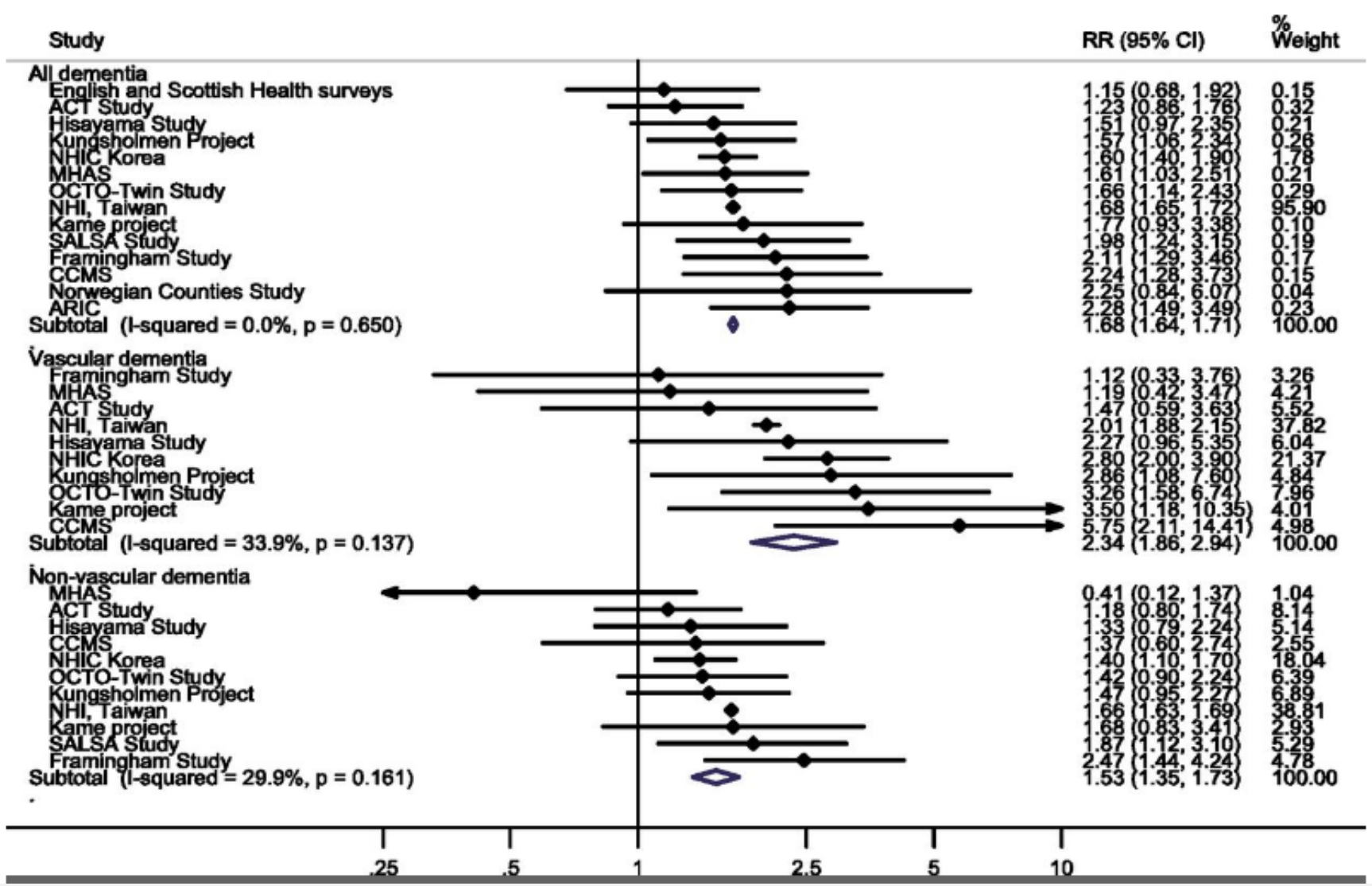
Cognitive decline as assessed by the DSS

	DM (n)	No DM (n)	OR and 95% CI
Fontbonne et al	55	768	2.3 (1.2, 4.3)
Gregg et al	339	5098	1.6 (1.2, 2.2)
Total (95% CI)	**394**	**5866**	**1.7 (1.3, 2.3)**



DM– diabetes mellitus

Cukierman T, et al. Diabetologia. 2005;48(12):2460-9.



Huxley RR Diabetes Care 2016 Feb; 39(2): 300-307

DEMENTIA AND DIABETES

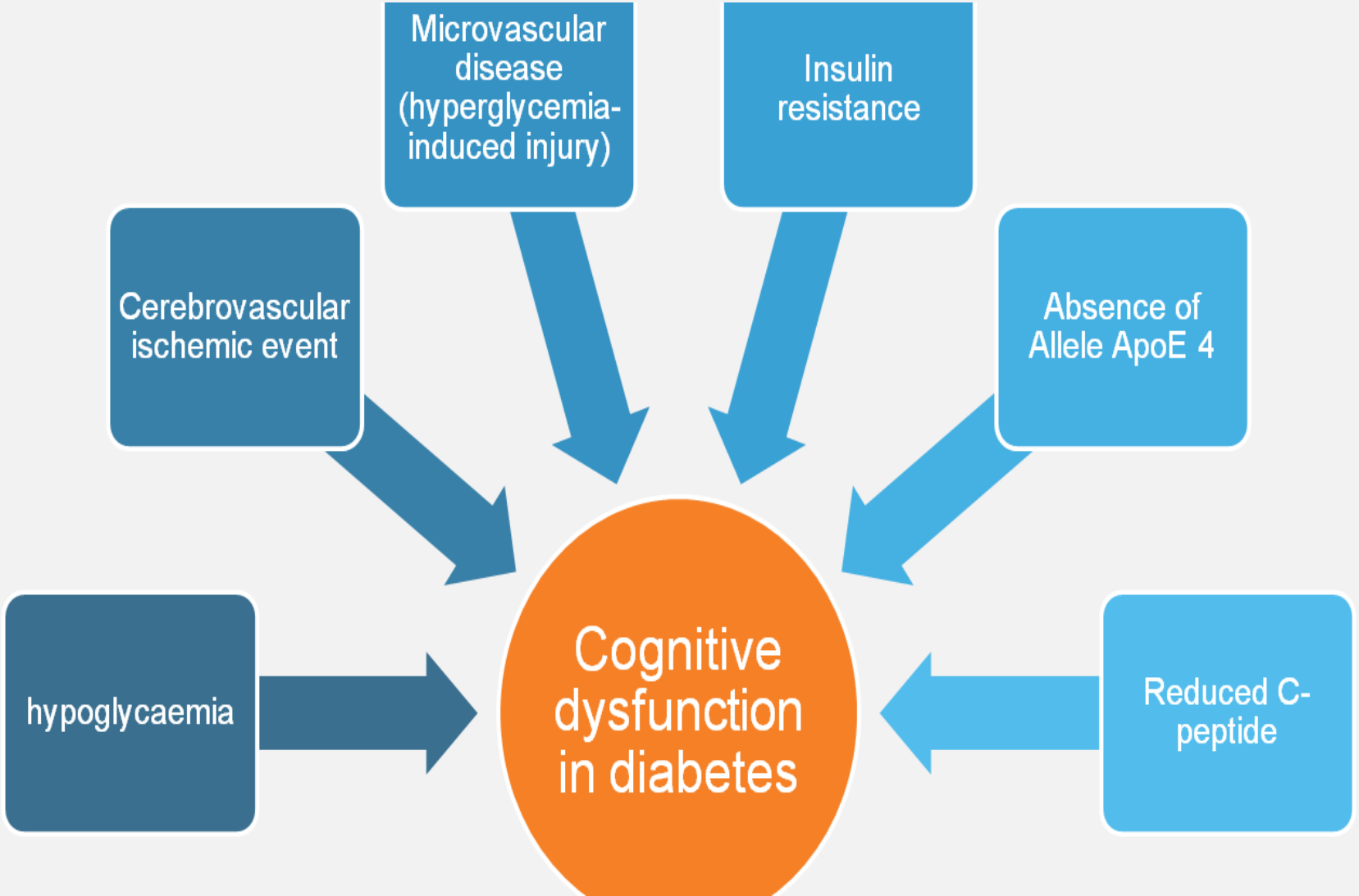
- Diabetes is a prevalent comorbidity in up to 39% of people with dementia depending on population sampling, with this figure more likely to be ~13% in large samples derived from primary care datasets.

- There is an increase in the risk of incident mild cognitive impairment of up to 60% and dementia (50%-100%) among those with type 2 diabetes compared with people without diabetes

- In one study - 3,433 older adults with type 1 diabetes, 155 (4.5%) individuals developed dementia over an average of 6.3 years of follow-up. Among those who developed dementia, the average age at dementia diagnosis was 64.6 years

Bunn F, Burn AM, Goodman C, et al. Comorbidity and dementia: a scoping review of the literature. BMC medicine 2014; 12: 192.
Rawlings AM, Sharrett AR, Albert MS, et al. The Association of Late-Life Diabetes Status and Hyperglycemia With Incident Mild Cognitive Impairment and Dementia: The ARIC Study. Diabetes Care 2019; 42(7): 1248-54.
Biessels GJ, Staekenborg S, Brunner E, Brayne C, Scheltens P. Risk of dementia in diabetes mellitus: a systematic review. Lancet Neurol 2006; 5(1): 64-74.
Lacy ME, Gilsanz P, Karter AJ, Quesenberry CP, Pletcher MJ, Whitmer RA. Long-term Glycemic Control and Dementia Risk in Type 1 Diabetes. Diabetes Care. 2018 Nov;41(11):2339-2345

PATHOPHYSIOLOGY



Kodl, et al. Endocrinol Rev 2008

MANAGEMENT CONSIDERATIONS

EFFECT DIABETES ON DEMENTIA

- Risks of uncontrolled hyperglycaemia (incl. DKA)
  → morbidity and mortality
  → accelerated cognitive decline

- Poor control and weight loss
- Hypoglycaemia presentation
- Communication
- Medication SE and interactions

IMPACT OF DEMENTIA ON DIABETES

- Poor control
- Not turning up for reviews

- Cognition and rate of change
  → medication compliance and timing
  → poor recognition and management of hypo or hyper glycaemia
  → difficulties in complex regimes

- Dependance on ADLs/management

- Hypoglycaemia presentation varies
- Dysphasia/communication
- Nutritional variation
- Dehydration

- Risk of infections
- Co-morbidities
- Variation in setting
- Frequent hospitalisation

TARGETS?

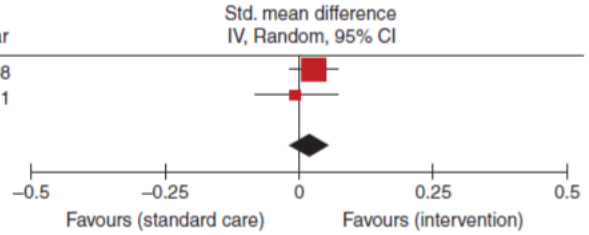
<7% (53mmol/mol)

Type 2 DM

7 – 8 % (53 – 64 mmol/mol)

Study or subgroup	Std. mean difference	S.E.M	Intervention Total	Standard care Total	Weight (%)	Std. mean difference IV, Random, 95% CI	Year
ADVANCE	0.029	0.0212	4503	4376	76.1	0.03 (–0.01, 0.07)	2008
ACCORD MIND	–0.0042	0.0378	1378	1416	23.9	–0.00 (–0.08, 0.07)	2011
Total (95% CI)			5881	5792	100.0	0.02 (–0.02, 0.06)	

Heterogeneity: τ^2=0.00; χ^2=0.59, df=1 (P=0.44); I^2=0%
Test for overall effect: Z=1.14 (P=0.25)



Study or subgroup	Std. mean difference	S.E.M	Intervention Total	Standard care Total	Weight (%)	Std. mean difference IV, Random, 95% CI	Year
IDEATel	0.1288	0.043	1093	1076	17.2	0.13 (0.04, 0.21)	2011
ADDITION	–0.306	0.1734	71	64	1.1	–0.31 (–0.65, 0.03)	2012
ORIGIN	0.0075	0.0197	5120	5200	81.8	0.01 (–0.03, 0.05)	2014
Total (95% CI)			6284	6340	100.0	0.03 (–0.01, 0.06)	

Heterogeneity: χ^2=10.26, df=2 (P=0.006); I^2=81%
Test for overall effect: Z=1.40 (P=0.16)

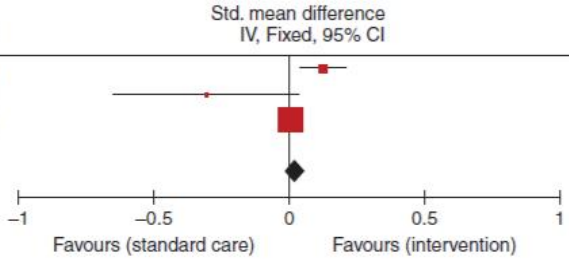


Table 3—Dementia risk by majority HbA_{1c} exposure

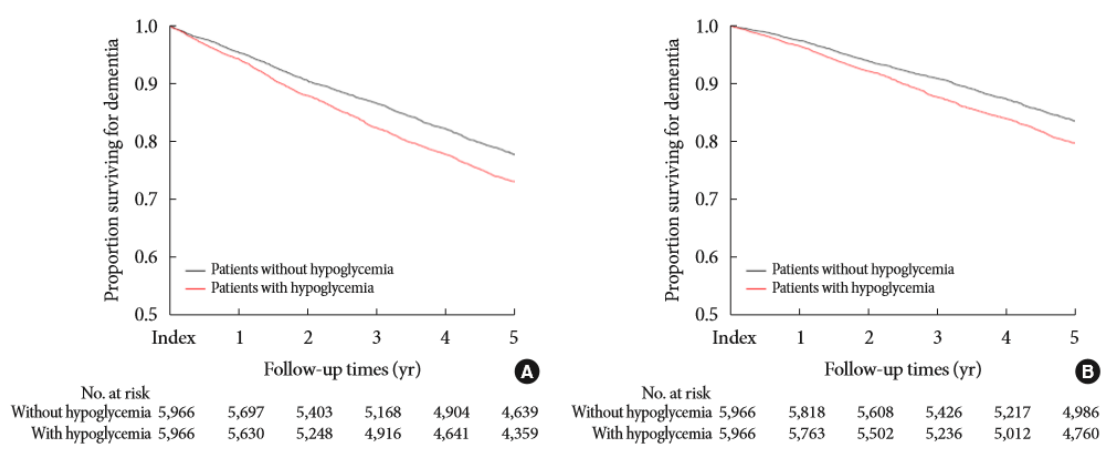
>50% of HbA_{1c} measurements	Age-adjusted HR (95% CI)	HR (95% CI) adjusted for race and sex	HR (95% CI) adjusted for race, sex, and baseline health conditions*	HR (95% CI) adjusted for race, sex, baseline health conditions,* and frequency of HbA_{1c} measurement
<6%	2.06 (1.11, 3.82)	2.03 (1.10, 3.78)	1.44 (0.75, 2.77)	1.45 (0.71, 2.92)
6–6.9%	0.55 (0.34, 0.88)	0.53 (0.33, 0.85)	0.54 (0.34, 0.87)	0.55 (0.34, 0.88)
7–7.9%	0.52 (0.35, 0.77)	0.55 (0.37, 0.82)	0.55 (0.37, 0.82)	0.55 (0.37, 0.82)
8–8.9%	1.57 (1.01 2.46)	1.58 (1.01, 2.47)	1.64 (1.05, 2.57)	1.65 (1.06, 2.57)
≥9%	1.82 (1.14, 2.90)	1.80 (1.12, 2.89)	1.80 (1.11, 2.90)	1.79 (1.11, 2.90)

Estimates obtained from Cox proportional hazards models with age as time scale. *Each of the following baseline health conditions was adjusted for in the model: history of stroke, myocardial infarction, nephropathy, neuropathy, severe diabetic retinopathy, peripheral arterial disease, hyperglycemic events, and hypoglycemic events.

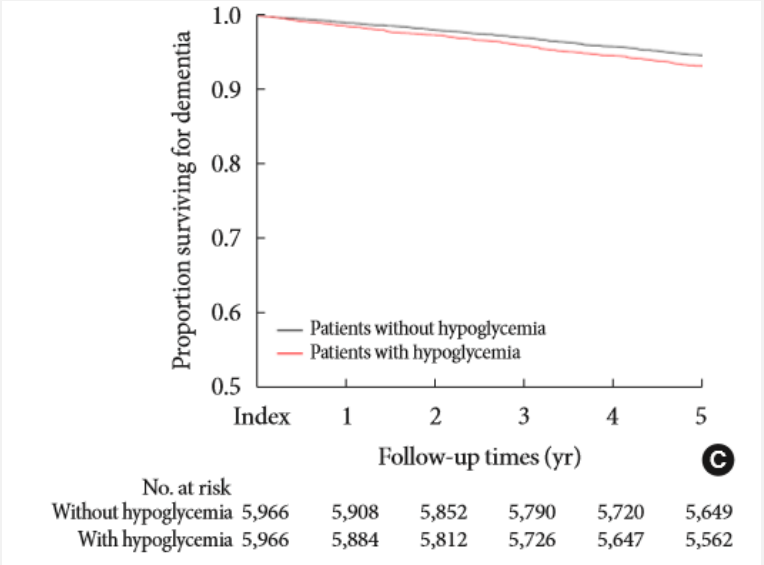
Type 1 DM

Tuligenga RH. Int. *Endocr Connect* 2015;4(2):R16–R24
Lacy ME et al Diabetes Care. 2018 Nov;41(11):2339-2345.

HYPOGLYCAEMIA AND DEMENTIA RISK IN OLDER ADULTS



A – all cause, **B** –Alzheimer's **C** - vascular



Variable	Number	Events	HR	95% CI	*P* value
All-cause dementia	11,932	2,934	1.254	1.166–1.349	<0.001
Alzheimer's disease	11,932	2,186	1.264	1.162–1.375	<0.001
Vascular dementia	11,932	721	1.286	1.110–1.490	<0.001

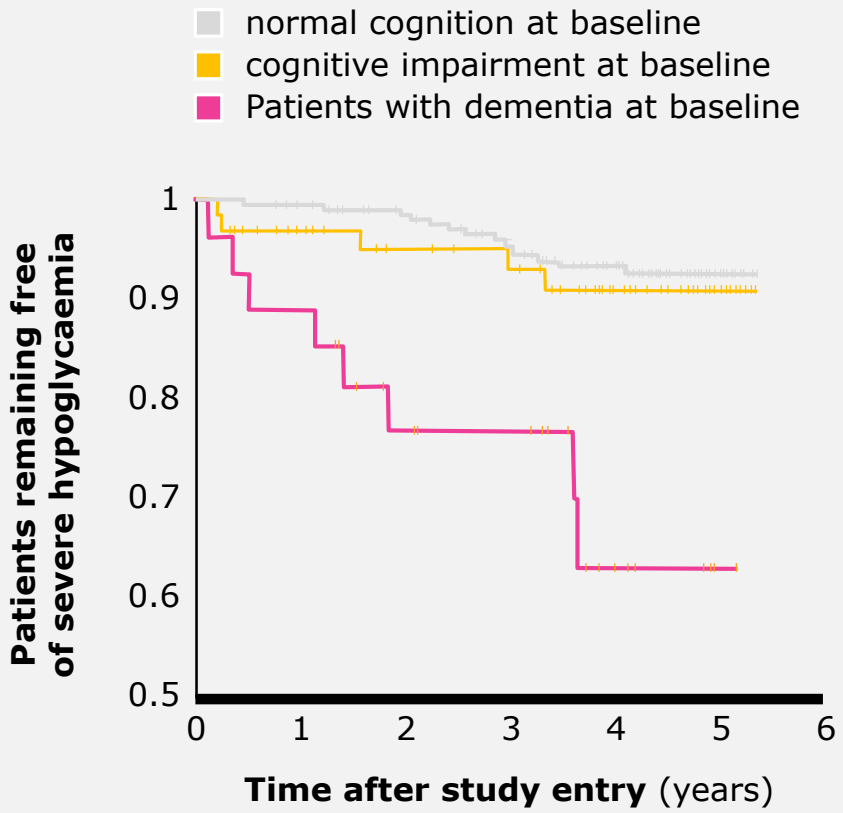
No. of previous hypoglycemic episodes	Number	Events	HR	95% CI	*P* value
1	4,622	1,159	1.170	1.043–1.313	0.008
2–3	2,946	550	1.201	1.016–1.421	0.032
>3	4,354	256	1.358	1.060–1.740	0.016

Kim YG et al. Diabetes Metab J. 2019 Oct 23. doi: 10.4093/dmj.2018.0260

The Fremantle Diabetes Study recruited patients with diabetes from an urban Australian community

- This sample had a mean age of 76 years:
  - Dementia was present in 9.3%
  - Cognitive impairment without dementia in 20%
- Dementia at baseline was a strong independent predictor of severe hypoglycaemia over the subsequent 5 years
- In patients with normal cognition at baseline, severe hypoglycaemias were not associated with further cognitive decline

These data suggest that severe hypoglycaemia does not cause cognitive impairment, but confirms that older diabetic patients with dementia are at increased risk of hypoglycaemia.



Bruce DG, et al. Diabetologia. 2009;52(9):1808-15.

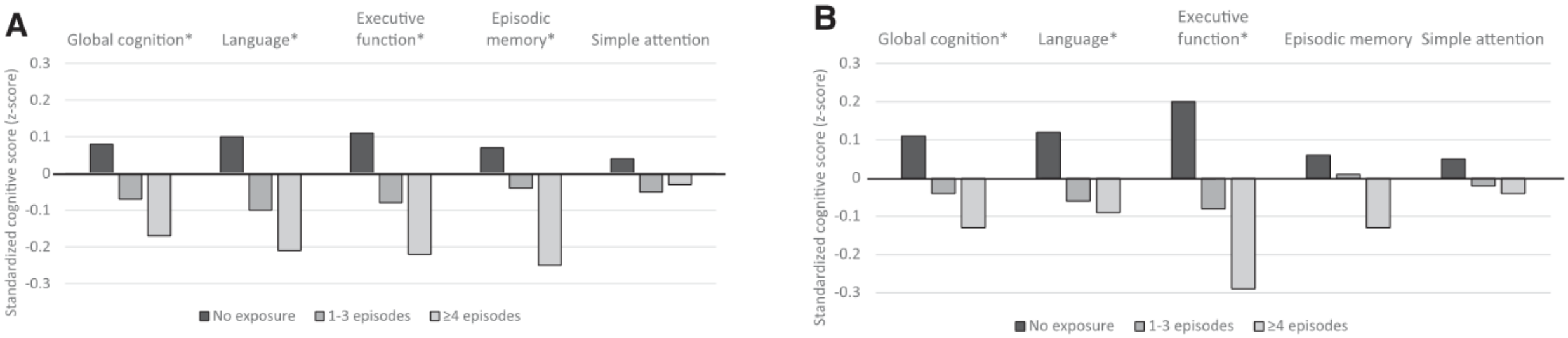


Figure 1—Mean standardized cognitive scores across categories of exposure to recent SH (*A*) and lifetime exposure to SH resulting in hospitalization or ED visit (*B*). **P* value for trend significant at <0.01.

SOLID

Lacy ME et al. Severe Hypoglycemia and Cognitive Function in Older Adults With Type 1 Diabetes: The Study of Longevity in Diabetes (SOLID), Diabetes Care. 2019 Dec 27. pii: dc190906

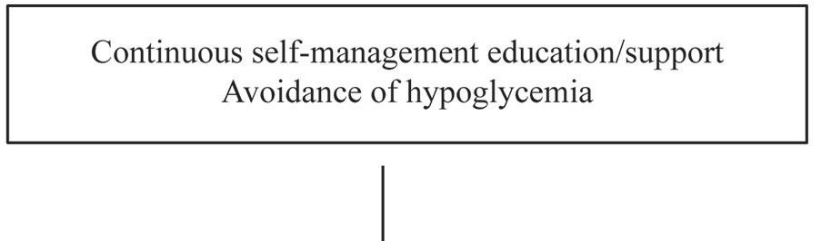
A SYSTEMATIC REVIEW OF THE EFFECT OF PRIOR HYPOGLYCAEMIA ON COGNITIVE FUNCTION IN TYPE 1 DIABETES

- SH is associated with CD in type 1 diabetes in an age-dependent manner. Exposure to prior SH has a mild-to-moderate effect on CF in early childhood and the older age group. More severe manifestations of SH like seizures and coma have a larger impact on CD. It is reassuring that exposure to SH during most of adolescence and adulthood is not associated with deficits in CF. SH remains a complication of insulin therapy, which we should strive to avoid at all ages, but most importantly at the two crucial periods: the early childhood and the older age groups.

Rama Chandran, Suresh et al. “A systematic review of the effect of prior hypoglycaemia on cognitive function in type 1 diabetes.” *Therapeutic advances in endocrinology and metabolism* vol. 11. 14 Feb. 2020, doi:10.1177/2042018820906017

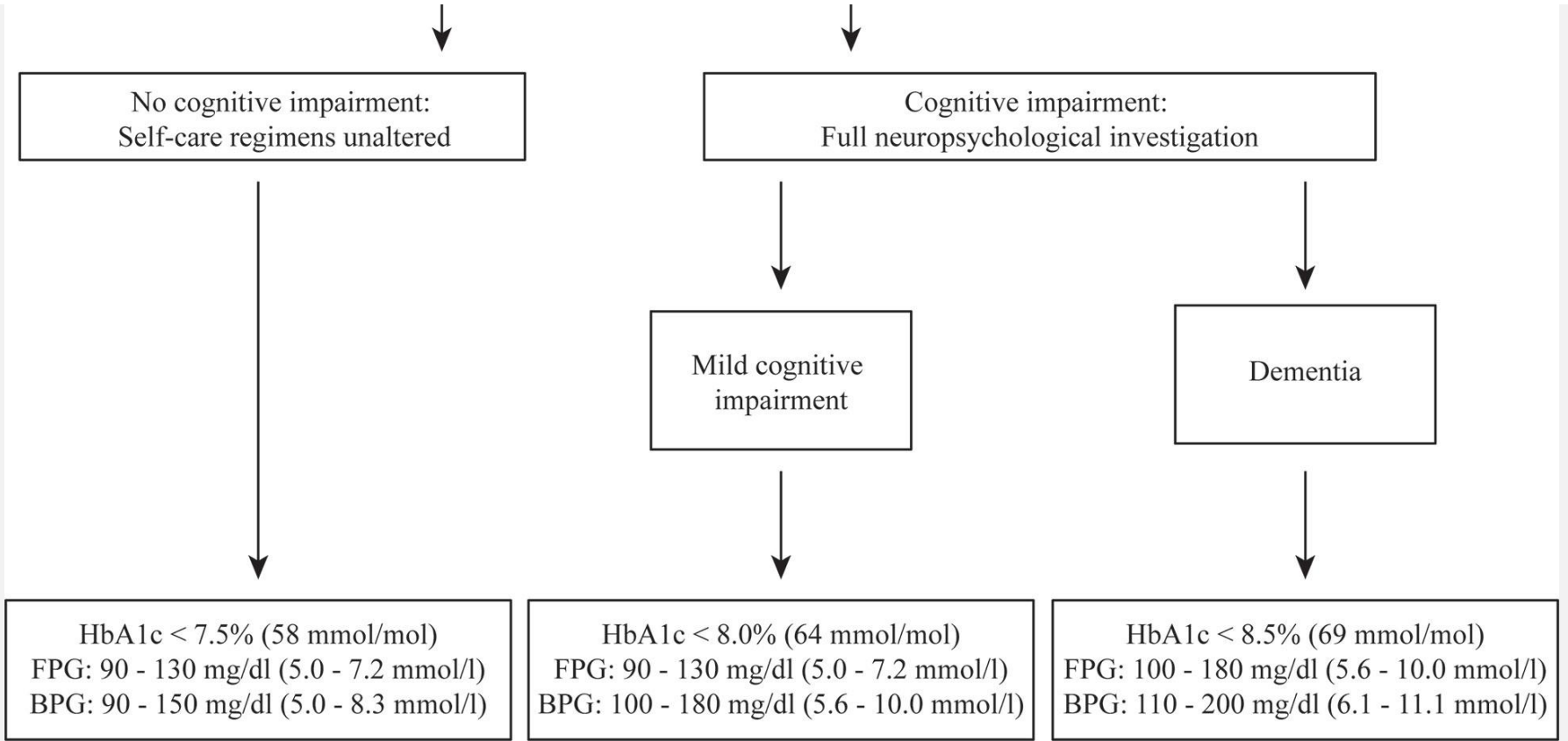
	Hba1c target	Fasting target	Postprandial target
IDF	8.5% (70mmol/mol)	-	-
DUK	7 - 8% (53 - 64mmol/mol)	7 – 8.5mmol/l	8 – 12mmol/l
Expert working group panel	7 - 8% (53 - 64mmol/mol)	6-9mmol/l	-
ADA mild-mod cognitive impairment	<8% (64mmol/mol)	90-150mg/dl (5-8.3mmol/l)	100-180mg/dl (5.5-10mmol/l) bedtime
ADA mod-severe cognitive imairment	<8.5% (70mmol/mol)	100-180mg/dl (5.5-10mmol/l)	110-200mg/dl (6.1-11.6mmol/l)

T1DM elderly-centered care



Recommendation

13.3 Screening for early detection of mild cognitive impairment or dementia should be performed for adults 65 years of age or older at the initial visit, annually, and as appropriate. **B**



Taboada Gjorup AL, Snoek FJ, van Duinkerken E. Diabetes Self-Care in Older Adults With Type 1 Diabetes Mellitus: How Does Cognition Influence Self-Management. Front Clin Diabetes Healthc. 2021 Sep 13;2:727029.

PRACTICAL CONSIDERATIONS

1. Routine and Consistency

- **Establish a structured daily routine** to minimize confusion. This should include regular meal times, medication schedules, and consistent blood sugar monitoring.
- **Simplify tasks**: Break down complex tasks into smaller, manageable steps. For example, preparing meals or taking medications can be made easier by having pre-measured ingredients or reminder systems in place.
- **Create a safe environment**: Adapt the living space to reduce the risk of injury. This includes removing tripping hazards and labeling essential items.

2. Blood Sugar Management

- **Monitor blood sugar levels regularly**: Fluctuating blood sugar levels can exacerbate cognitive impairment. Work with a healthcare provider to set up an individualized blood sugar management plan that accommodates both diabetes and dementia care.
- **Technology**: Consider using continuous glucose monitors (CGMs) or insulin pumps. These tools help keep blood sugar levels in check and can make it easier for caregivers to manage blood sugar levels, even if the patient struggles with memory.
- **Education for caregivers**: Caregivers should be trained on recognizing symptoms of both hypo- and hyperglycemia. Early intervention can prevent complications, such as severe cognitive impairment caused by extreme blood sugar levels.

PRACTICAL CONSIDERATIONS

3. Medication Management

- **Medication management systems**: Pill organizers, alarms, or apps to help track medications and ensure they are taken correctly. Some patients may forget to take their insulin, leading to swings in blood glucose levels.
- **Simplify medications**

4. Cognitive and Mental Health Support

- **Engage in cognitive exercises**: Activities such as puzzles, reading, or memory games can help stimulate the brain and slow cognitive decline. Gentle mental exercises, even if brief, can support memory retention and improve quality of life.
- **Social interaction**: Encourage socializing with family and friends, as meaningful conversations and social activities can help delay the progression of dementia symptoms.
- **Psychological support**: Both patients and caregivers may benefit from counseling or support groups. Caregivers, in particular, are often under stress and may need assistance in coping with the dual burden of managing diabetes and dementia.

PRACTICAL CONSIDERATIONS

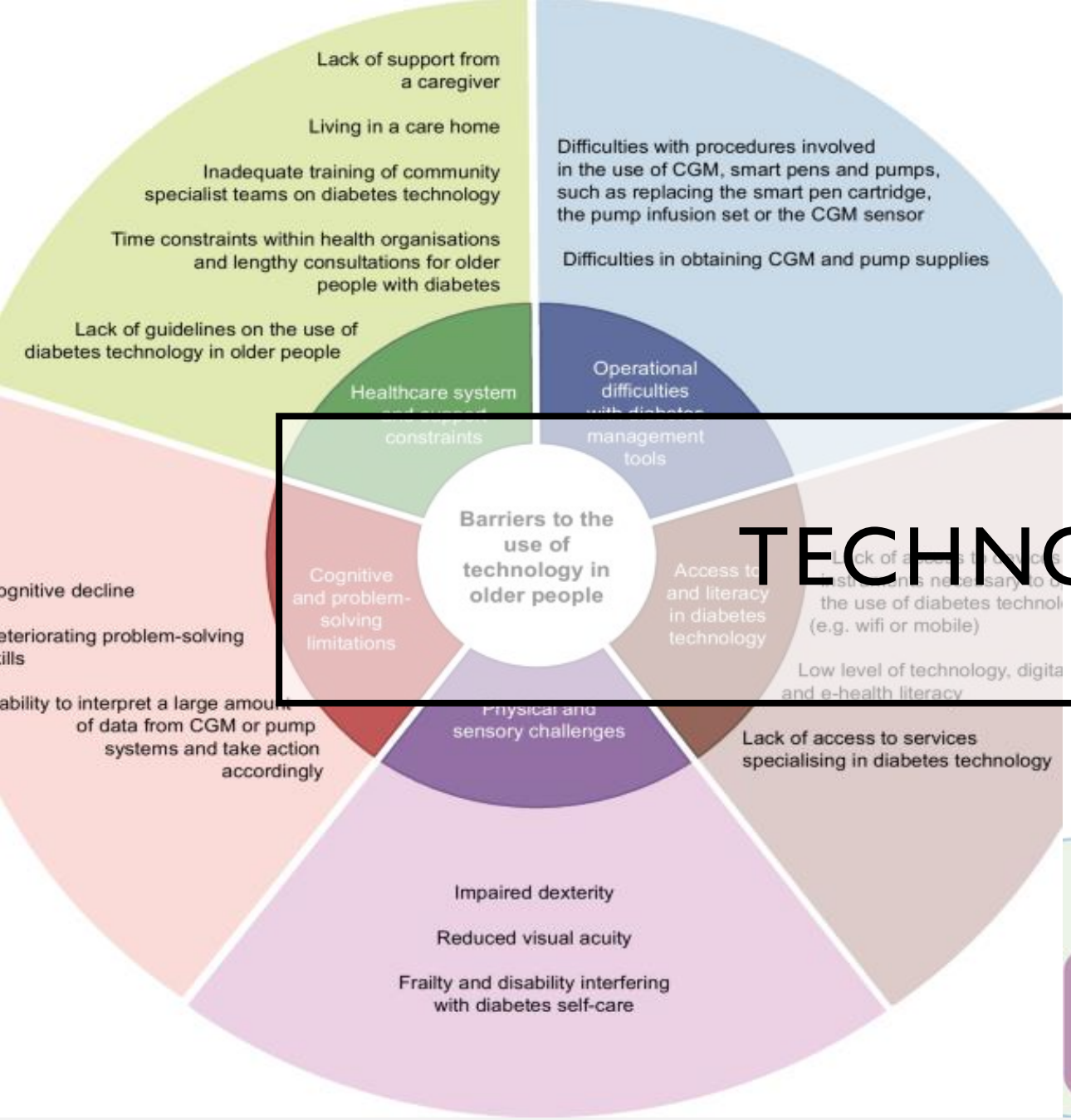
5. Diet and Nutrition

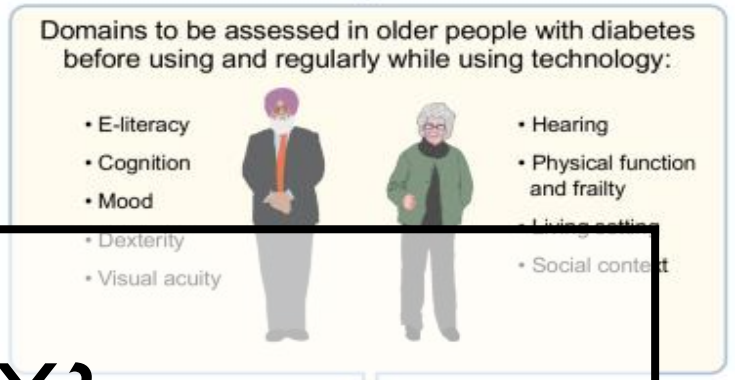
- **Healthy meals vs encouraging oral intake**
- **Hydration**: Encourage adequate water intake, as dehydration can negatively impact both blood sugar control and cognitive function.

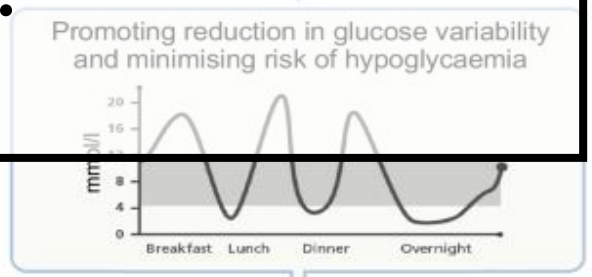
6. Communication and Safety Considerations

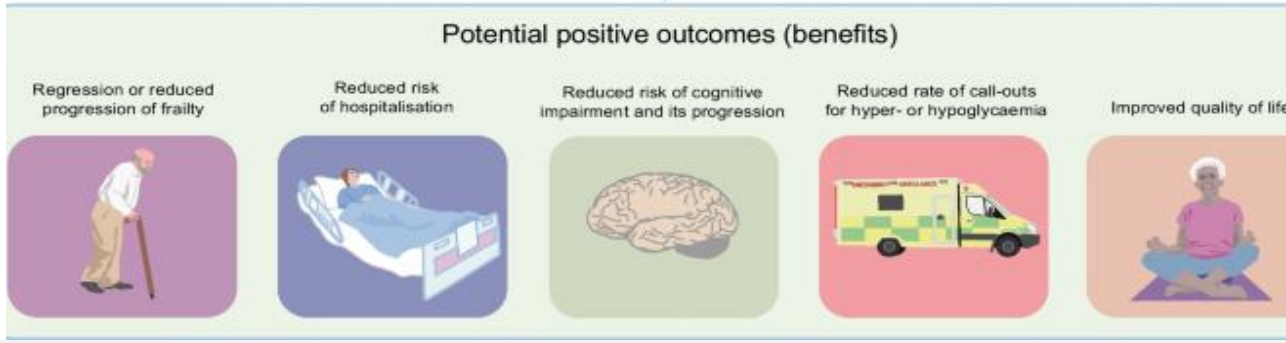
- **Clear communication**
- **Safety monitoring**: Consider using medical alert systems or GPS tracking devices for safety.
- **Emergency planning**: It's vital for caregivers to know what to do in the event of a medical emergency. Have a list of emergency contacts and clear instructions on how to manage both a diabetic emergency and a dementia-related crisis.

Emotional Support for Caregivers









TECHNOLOGY?

Maltese G, McAuley SA, Trawley S, Sinclair AJ. Ageing well with diabetes: the role of technology. Diabetologia. 2024 Oct;67(10):2085-2102. doi: 10.1007/s00125-024-06240-2

CASE STUDY

- 76 year old lady
- T1DM 40+ years on basal bolus insulin regime with first generation basal analogue 36 units ON, prandial insulin
- Lives alone and states manages well
- Admitted few weeks prior with hyperglycaemia, insulin adjusted and discharged.

- Now – admitted with hyperglycaemia + infection
- Improved, alert and interacting
- Started back on usual insulin regime
- Recurrent hypos…. ?

CASE STUDY CONTD.

- Insulin dose adjusted i.e. reduced, BG stable and discharged.
- Hba1c 89mmol/mol
- Admitted <1 week later – hyperglycaemia and dehydration
- Resolved… hypos again
- Insulin adjusted, patient states comfortable with insulin regime and administration.

- What next?

CASE STUDY CONTD

- AMT 6/10, further cognitive assessment – moderate cognitive impairment
- Considerations?

- Family members ? Carers?

- Recurrent admissions over the next few months with hyperglycaemia

- What next?
- Considerations?

CASE CONCLUSION

- Care plan with DN visits, insulin administration and dose adjustment depending on BG
- 2nd generation basal insulin
- CGM
- Care home with 24hr care
- Hospital team contact

DIADEM

- **D** : Determine degree of cognitive impairment/ deterioration and self management
- **I** : Involve patient, carers and family in discussion and decision making
- **A** : Assess and set goal (HbA1C, blood sugars- fasting/post prandial)
- **D** : Determine hypoglycaemia risk
- **E** : Evaluate diabetes complications and potential vascular risk avoidance (including foot review)
- **M** : Monitor for change in status/ trends in glycaemia/ hospital admission and re-asses

CONCLUSION

- Type 1 diabetes and dementia will become an increasingly encountered clinical management scenario with longer life expectancy and multimorbidity
- Awareness by the clinician and health economy is important to pro-actively case find and address
- Clinical intervention trials are minimal
- Current strategies focus on relaxing regimes with avoidance of hypoglycemia
- Patient focused care accounting for degree of cognition, location and support available.
- Use of technology has its benefits… and limitations

Case vignette: comorbidities and cognitive decline limiting the use of diabetes therapeutic technology

A 74-year-old woman with type 1 diabetes since her mid-30s was admitted to hospital in January 2021 with back pain and hypoglycaemia, in the setting of worsening cognition. She was living at home with her supportive female partner. She mobilised with a four-wheeled frame, with exercise tolerance of ~400 m (limited by back pain).

Her insulin therapy involved multiple daily injections, with once-daily long-acting basal insulin and rapid-acting insulin pre meals. Glucose monitoring was performed intermittently using a Dexcom G5 system, and finger-prick blood glucose testing was used on other occasions. Her HbA_{1c} was 75 mmol/mol (9.0%). She had micro- and macrovascular diabetes-related complications, including ischaemic heart disease, peripheral vascular disease, history of transient ischaemic attack, microalbuminuria, neuropathy, retinopathy with visual impairment, heel ulcer and gastroparesis. Other comorbidities included schizophrenia, lumbar spinal canal stenosis, hypertension and inflammatory arthritis.

On admission, CGM data were not accessible as she was using a phone-based CGM application and could not recall her iPhone password. Her glucose levels were labile in hospital, and insulin dose adjustments were made after review of her glucose pattern and dietary intake. Diabetes education was provided, including around insulin dose self-adjustment, and this contributed to worsening anxiety symptoms. Once medically stabilised, she was discharged home with the maximal available community support and district nursing visits to assist with glucose monitoring and insulin administration.

Over the next 8 months, she had a further ten presentations to the hospital emergency department, with seven hospital admissions. These presentations were either with severe hypoglycaemic episodes, hyperglycaemia with and without ketosis, or functional decline, with coexistent confusion on some occasions. She was assessed as being unable to safely manage with an insulin pump or to understand CGM information, and her partner was not able to be present with her all the time for diabetes management and troubleshooting. During the final admission, arrangements were made to transfer her to a residential aged care facility where full-time diabetes care could be provided. The staff in the facility were unfamiliar with CGM and did not have capacity to upskill in this area. Glucose monitoring was undertaken by capillary blood testing and insulin doses for injections were overseen by the treating doctor at the residential facility. There were no further hospital presentations during the following year.

This case highlights the limitations of using diabetes technology in the setting of extensive comorbidities, including visual impairment, and when an individual's capability for diabetes self-management deteriorates. The currently available technology still requires the person with diabetes, or their caregivers, to have sufficient understanding and capability to interpret the information collected and to act on this for diabetes management.

THANK YOU

@AmarPut

@GoggleDocs