

ADVANCED TRACK

PROTECTING BONES AND BRAINS: DIABETES AND THE BRAIN

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Fracture Risk in Diabetes

Type 1 diabetes and risk of fracture: meta-analysis and review of the literature

V. N. Shah¹, C. S. Shah² and J. K. Snell-Bergeon¹

- 27,300 patients with type 1 diabetes
- 4,364,125 controls without diabetes

Fracture risk is 300-400% higher in people with type 1 diabetes

Osteoporos Int (2017) 28:3113–3121
DOI 10.1007/s00198-017-4183-0



ORIGINAL ARTICLE

Risk of low-energy fracture in type 2 diabetes patients: a meta-analysis of observational studies

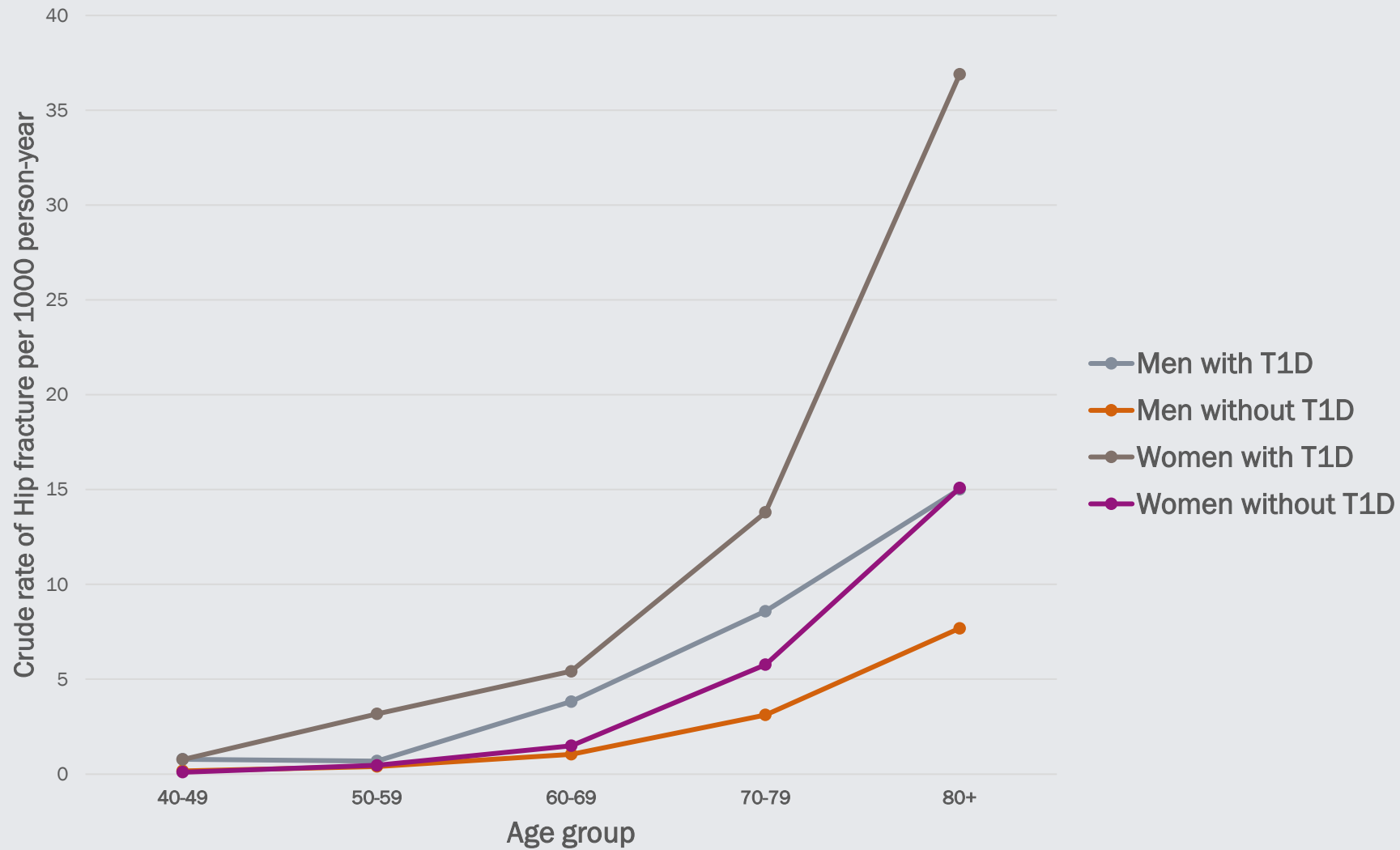
P. Jia¹ · L. Bao¹ · H. Chen¹ · J. Yuan² · W. Liu² · F. Feng¹ · J. Li¹ · H. Tang¹

- 272,717 patients with type 2 diabetes
- 666,025 controls without diabetes

Fracture risk is 20-30% higher in people with type 2 diabetes

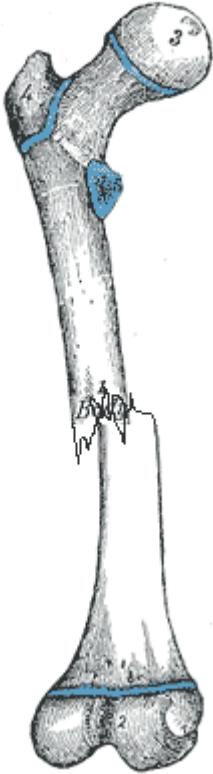
FRACTURE RISK BY AGE AND SEX IN T1D

Hip fracture by gender in subjects with T1D compared to subjects without T1D



WHY FRACTURE RISK IS HIGH IN DIABETES?

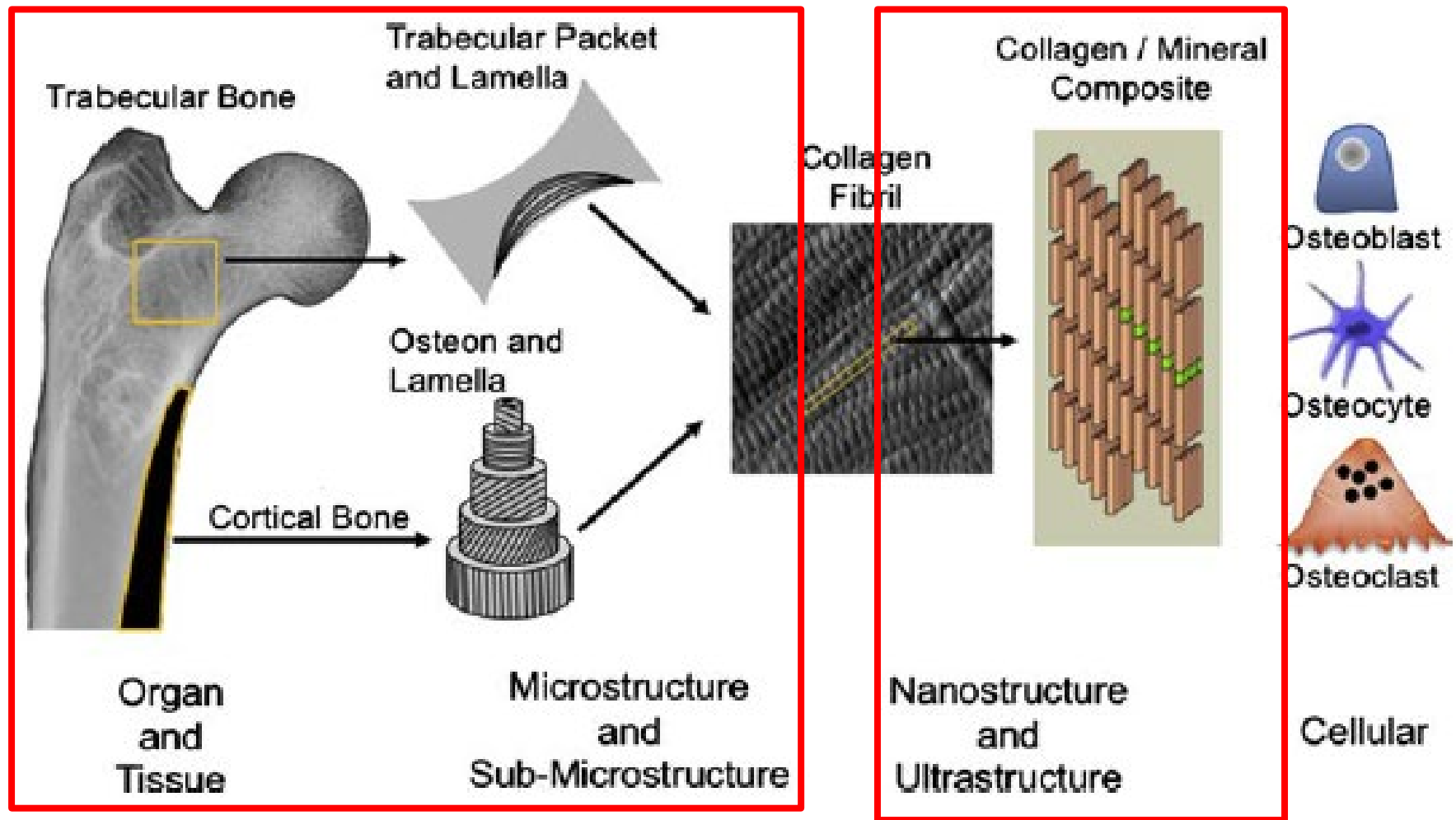
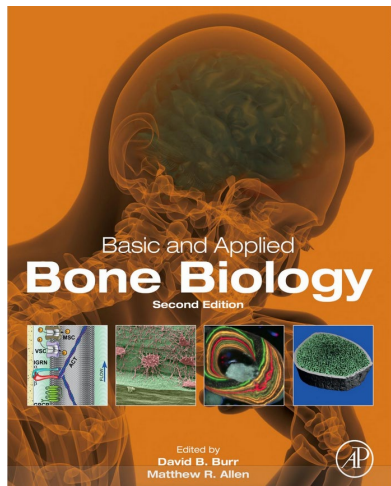
Bone Mineral
Density



Bone Quality




Frequent Falls



WHAT YOU CAN DO TO KEEP YOUR BONES HEALTHY?

1. Be aware of this complication
2. **Speak with your doctor for osteoporosis screening**
3. Have adequate calcium and vitamin D in diet. Taking more than required calcium or vitamin D is not helpful
4. **Regular exercise to improve strength and balance**
5. **Fall assessment and Prevention**

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CALCIUM

[CALCIUM](#) [CALCIUM MAP](#) **[CALCIUM CALCULATOR](#)** [LIST OF CALCIUM CONTENT OF COMMON FOODS](#) [CALCIUM RECOMMENDATIONS](#)

Language Country Step 1 of 2

Are you getting


ENOUGH CALCIUM ?

Calcium is essential for building and maintaining healthy bones at all ages. Find out whether you are getting enough of this important mineral in your daily diet by using this simple calculator.

GENDER male female **AGE**

Have you ever been diagnosed with osteoporosis or osteopenia?

yes no



STEADI—Older Adult Fall Prevention

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If you have questions about property valuation and property tax, visit boco.org/2023Valuation.

FALLS PREVENTION

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Falls Prevention Resources

Falls Prevention Week 2022 Schedule/Descriptions



Boulder County Partners for Falls Prevention

Falls prevention is a team effort and everyone has a role to play to reduce falls risk. Join us to learn how strengthening community connections can keep you and those you care for safe with our activities during Falls Prevention Week 2022.

Resources For Older Adults


- [Adult Protection & Senior Services](#)
- [Area Agency on Aging](#)
- [Caregiving Support](#)
- [Healthy Aging](#)
- [Long-Term Care Ombudsman](#)
- [Medicare](#)
- [Old Age Pension \(OAP\)](#)
- [Property Tax Help for Older Adults](#)
- [Veterans Services](#)

[Home](#) > [Specialties](#) > [Community health](#) > [Stepping On](#)

Stepping On

Stepping On is a program that has been researched and proven to reduce falls in older people.

WHAT YOU CAN DO TO KEEP YOUR BONES HEALTHY?

6. Have optimal blood sugar control from the early onset of diabetes
 7. Take medication if you are diagnosed with osteoporosis to help prevent further bone loss
 8. Take part in research so that we can learn and treat this condition better
- 

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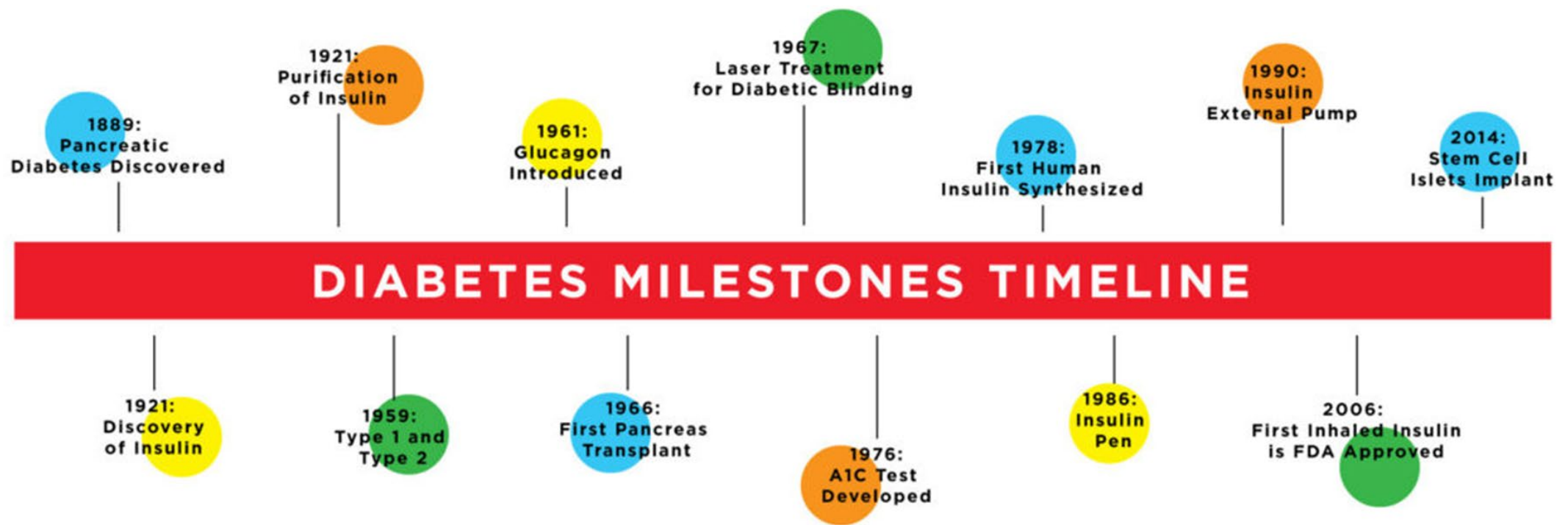
I have no conflicts of interest to disclose.



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- As diabetes treatments advance, people are “...surviving and thriving into their later decades.”
- We are learning more about T1D and issues associated with aging.

1. Image: Christina Kalberg, “Next Stop a Cure? A Quick History of Diabetes Research”, beyondtype1.org
 2. EISayed NA, et al. Older Adults: Standards of Care in Diabetes 2023. *Diabetes Care*. 2023.



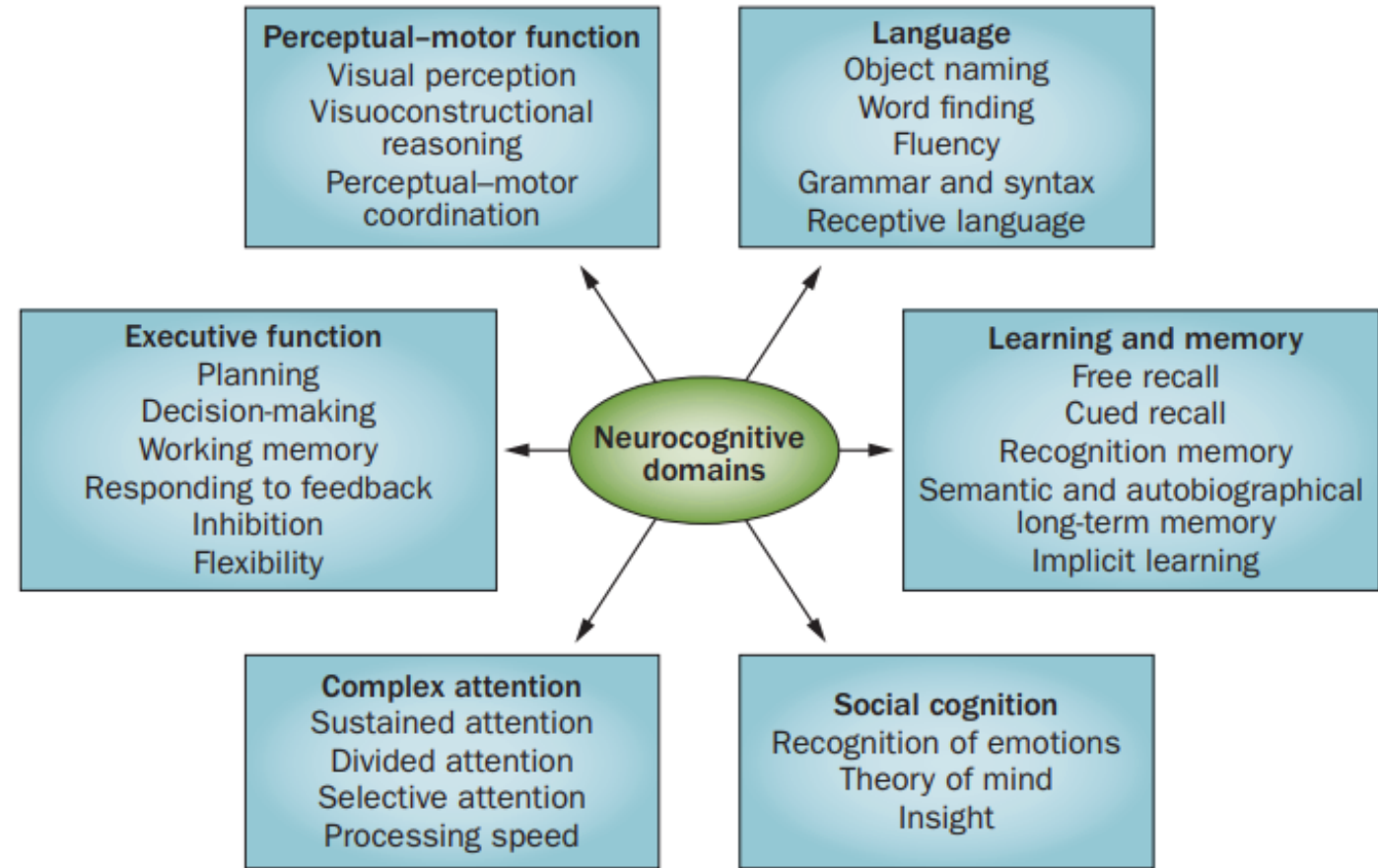
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DIABETES & THE BRAIN

- Cognitive function:
 - Learning, thinking, reasoning, remembering, problem solving, decision making, attention.



1. Sachdev PS, et al. Classifying neurocognitive disorders: the DSM-5 approach. *Nat Rev Neurol*. 2014.



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DIABETES & THE BRAIN

- Differences in brain structure.
- Lower cognitive performance scores.
 - IQ typically in normal range.
- Increased rates of cognitive impairment and dementias in older age.
 - “Accelerated brain aging”.
- Diabetes and depression negatively impact cognition in a collaborative way.
- Cognitive functioning may impact home diabetes management.

1. ElSayed NA, et al. Older Adults: Standards of Care in Diabetes 2023. *Diabetes Care*. 2023.
2. Xue, et al. Diabetes mellitus and risks of cognitive impairment and dementia: A systematic review and meta-analysis. *Ageing Research Reviews*. 2019.
3. Schwartz, et al. Neurocognitive outcomes in pediatric diabetes: A developmental perspective. *Curr Diab Rep*. 2014.
4. Jacobson AM, et al. Cognitive performance declines in older adults with T1D: results from 32 years of follow-up in DCCT/EDIC. *Lancet Diabetes Endo*. 2021.



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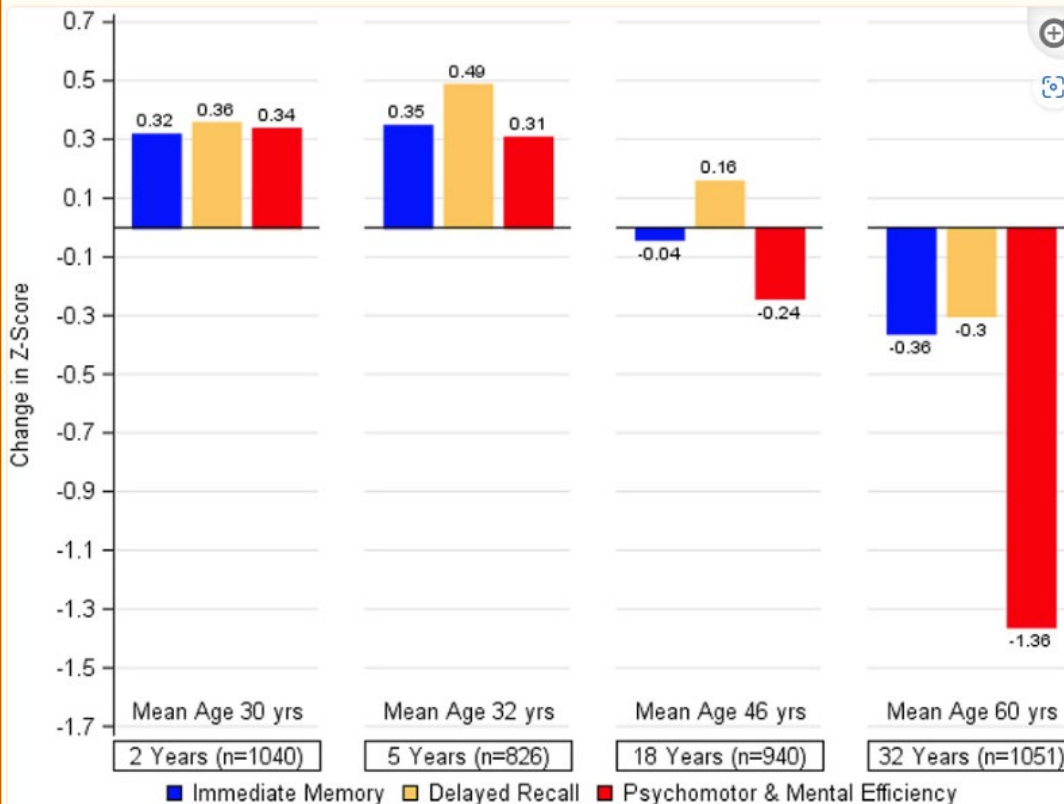
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Articles

Cognitive performance declines in older adults with type 1 diabetes: results from 32 years of follow-up in the DCCT and EDIC Study



Associated Factors:

- Higher A1c trends
 - 1 % increase = 3.3 years of aging
- History of severe hypoglycemia
 - 1+ event = 4.6 years of aging
- Higher systolic blood pressure
 - 5 point increase = 4.0 years of aging
- Other diabetes-related complications
 - Kidney disease
 - Eye disease
 - Cardiovascular disease

“...proportion of participants who met criterion for mild cognitive impairment was quite low (5.5%, n=58).”

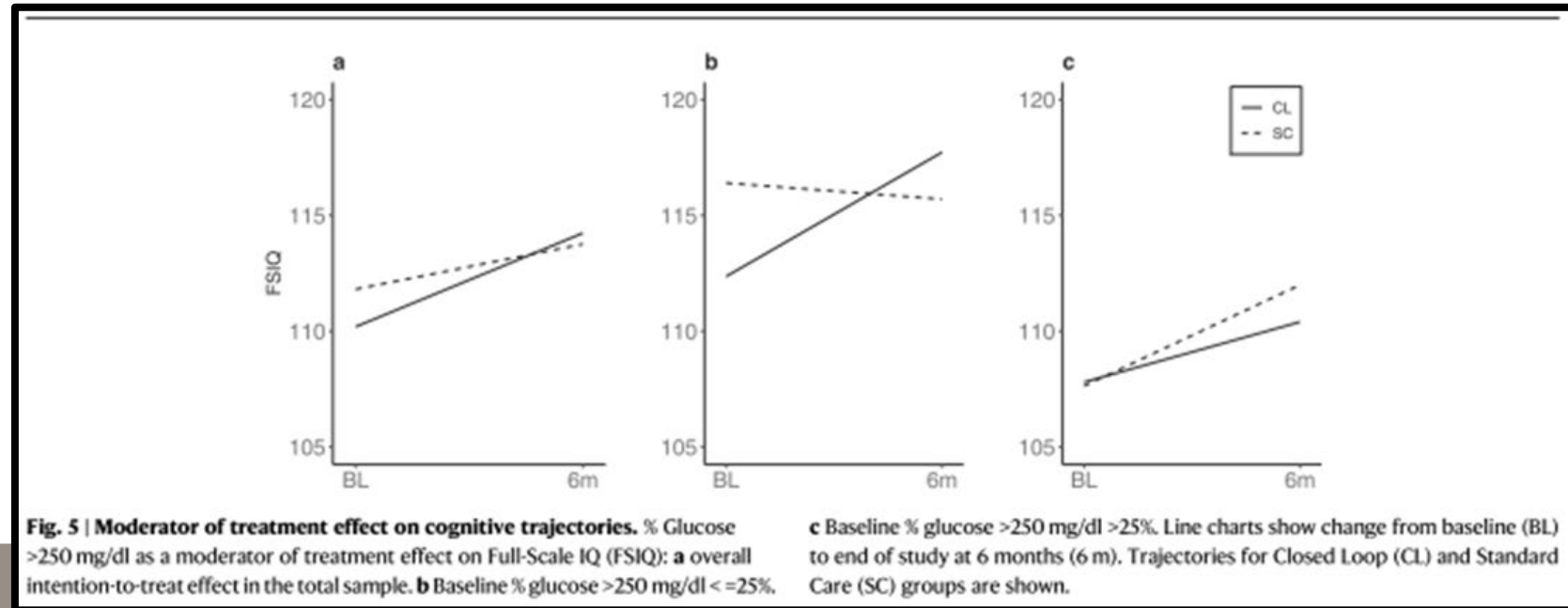
BRAIN HEALTH

- Glucose and A1c trends
 - Lower A1cs / Higher time in range (TIR)
 - Avoid glycemic extremes

Article

<https://doi.org/10.1038/s41467-022-32289-x>

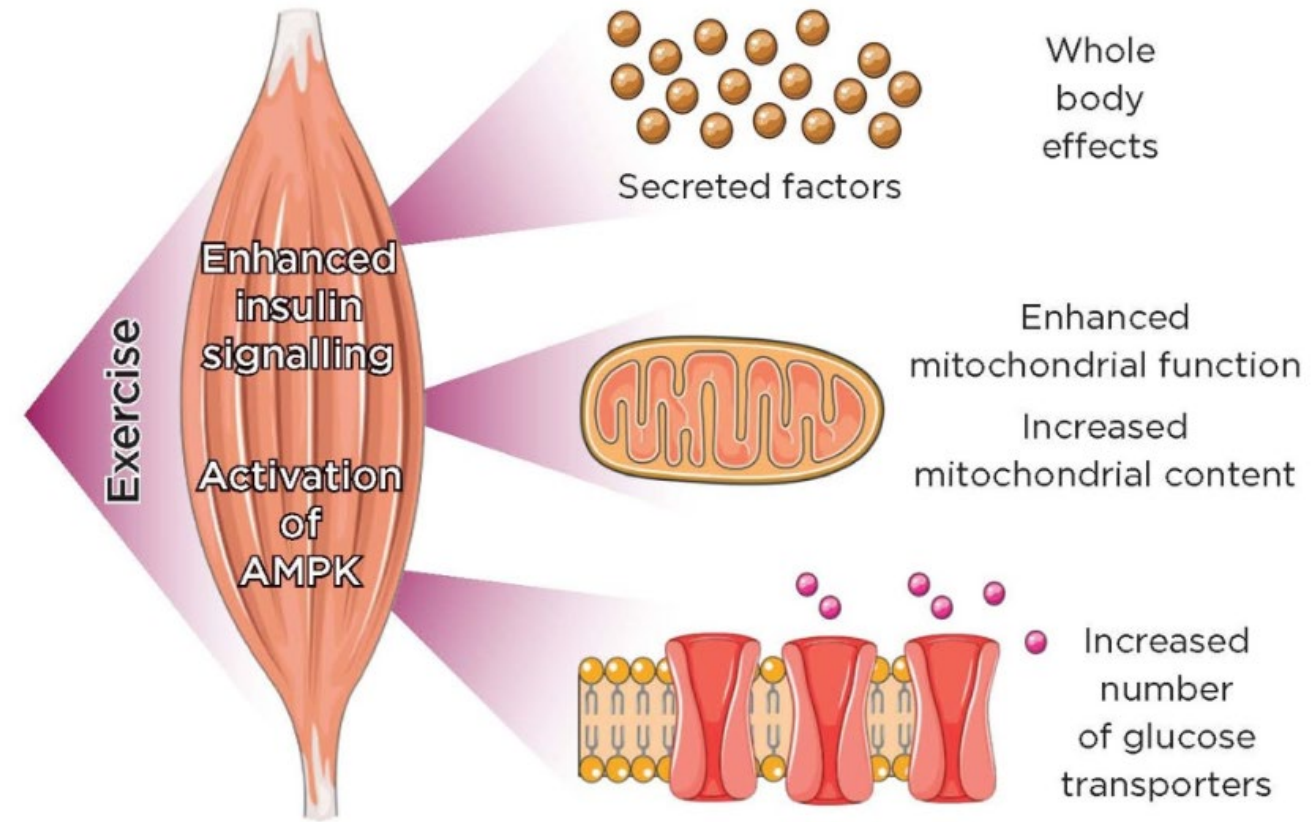
A Pilot randomized trial to examine effects of a hybrid closed-loop insulin delivery system on neurodevelopmental and cognitive outcomes in adolescents with type 1 diabetes



1. Reiss AL, et al; Diabetes Research in Children Network (DirecNet) Consortium. A Pilot randomized trial to examine effects of a hybrid closed-loop insulin delivery system on neurodevelopmental and cognitive outcomes in adolescents with type 1 diabetes. *Nat Commun.* 2022.
2. EISayed NA, et al. Older Adults: Standards of Care in Diabetes 2023. *Diabetes Care.* 2023.
3. Jaser SS, et al. Brain Health in Children with Type 1 Diabetes: Risk and Protective Factors. *Curr Diab Rep.* 2021.

BRAIN HEALTH

- Prevent diabetic ketoacidosis (DKA)
 - Check ketones if ill, hyperglycemia
 - Insulin doses
 - Drink fluids
 - Balanced diet
- Reduce insulin resistance
 - Regular exercise



Some of the changes noted in skeletal muscle in response to exercise.

1. Image: Society for Endocrinology
2. Aye T, et al; Diabetes Research in Children Network (DirecNet) Study Group. Impact of Early DKA on the Developing Brain. *Diabetes Care*. 2019.
3. EISayed NA, et al. Older Adults: Standards of Care in Diabetes 2023. *Diabetes Care*. 2023.



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BRAIN HEALTH

- Prevent / manage micro- and macro-vascular complications related to diabetes
 - Blood pressure
 - Cholesterol
- Prevent / address diabetes burnout, mental health
 - Show grace
 - One step at a time
 - Ask for help
 - Talk to your doctor



JOB BURNOUT

- 1 Work related demands become overwhelming
- 2 Negative attitude towards work, colleagues.
- 3 Lack of reward / recognition for one's work from colleagues or managers.



DIABETES BURNOUT

- 1 Daily care demands of living with diabetes become overwhelming
- 2 Negative attitude towards diabetes diagnosis, reduced self-care behaviours
- 3 Lack of reward/recognition for one's efforts reflected in Blood Glucose, health measures, energy levels.

1. Image: beyondtype1.org
2. Musen G, et al. Cognitive Function Deficits Associated With Long-Duration Type 1 Diabetes and Vascular Complications. *Diabetes Care*. 2018
3. Jaser SS, et al. Brain Health in Children with Type 1 Diabetes: Risk and Protective Factors. *Curr Diab Rep*. 2021.

BRAIN HEALTH

■ Talk to your doctor

- International Society for Pediatric and Adolescent Diabetes (ISPAD):
 - Psychosocial health should be monitored, and psychosocial care should be integrated in clinical practice.
 - Cognitive capacity and school functioning should be monitored.
- American Diabetes Association (ADA):
 - Screening for early detection of mild cognitive impairment or dementia should be performed for adults >65 years at least yearly
 - Cognitive dysfunction makes it difficult for individuals to perform self-care tasks, maintain timing of meals and diet content... it is critical to simplify care plans and engage support.

1. ElSayed NA, et al. Older Adults: Standards of Care in Diabetes 2023. *Diabetes Care*. 2023.
2. de Wit M, et al. ISPAD Clinical Practice Consensus Guidelines: Psychological care of children, adolescents, young adults with diabetes. *Pediatr Diab*. 2022.



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5. Jacobson AM, Ryan CM, Braffett BH, Gubitosi-Klug RA, Lorenzi GM, Luchsinger JA, Trapani VR, Bebu I, Chaytor N, Hitt SM, Farrell K, Lachin JM; DCCT/EDIC Research Group. Cognitive performance declines in older adults with type 1 diabetes: results from 32 years of follow-up in the DCCT and EDIC Study. *Lancet Diabetes Endocrinol*. 2021 Jul;9(7):436-445. doi: 10.1016/S2213-8587(21)00086-3. Epub 2021 May 27. PMID: 34051936; PMCID: PMC8583716.
6. Reiss AL, Jo B, Arbelaez AM, Tsalikian E, Buckingham B, Weinzimer SA, Fox LA, Cato A, White NH, Tansey M, Aye T, Tamborlane W, Englert K, Lum J, Mazaika P, Foland-Ross L, Marzelli M, Mauras N; Diabetes Research in Children Network (DirecNet) Consortium. A Pilot randomized trial to examine effects of a hybrid closed-loop insulin delivery system on neurodevelopmental and cognitive outcomes in adolescents with type 1 diabetes. *Nat Commun*. 2022 Aug 30;13(1):4940. doi: 10.1038/s41467-022-32289-x. PMID: 36042217; PMCID: PMC9427757.
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9. de Wit M, Gajewska KA, Goethals ER, McDarby V, Zhao X, Hapunda G, Delamater AM, DiMeglio LA. ISPAD Clinical Practice Consensus Guidelines 2022: Psychological care of children, adolescents and young adults with diabetes. *Pediatr Diabetes*. 2022 Dec;23(8):1373-1389. doi: 10.1111/pedi.13428. Epub 2022 Dec 5. PMID: 36464988



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