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Glucose on the Ageing Mind

Healthy Brain Ageing Symposium

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Brain Ageing

- Normal brain ageing can be affected by a wide range of factors
  - Some are fixed
    - Disease (e.g. Dementia)
    - Genetics
  - Some are modifiable
    - Personal history and environment (e.g. learning)
    - Lifestyle (e.g. physical activity, diet)

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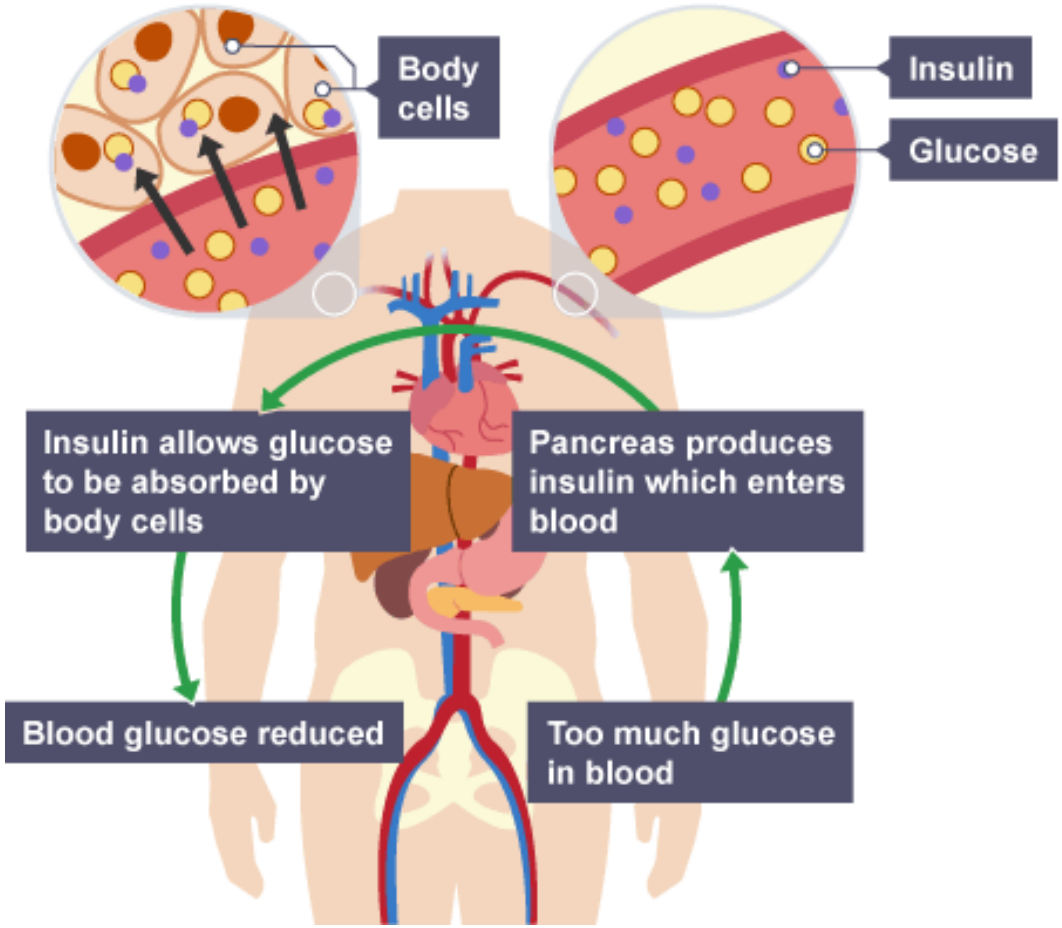
Blood glucose

Blood glucose is the amount of glucose present in the blood plasma.

- Glucose metabolism depends on complex interaction of many factors
  - Food
  - Medication
  - Physical Activity
  - Environment
  - Genetics



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Blood glucose

Blood glucose is the amount of glucose present in the blood plasma.

The brain needs glucose

- Energy source
- Needed to make neurotransmitters

Too much of a good thing…

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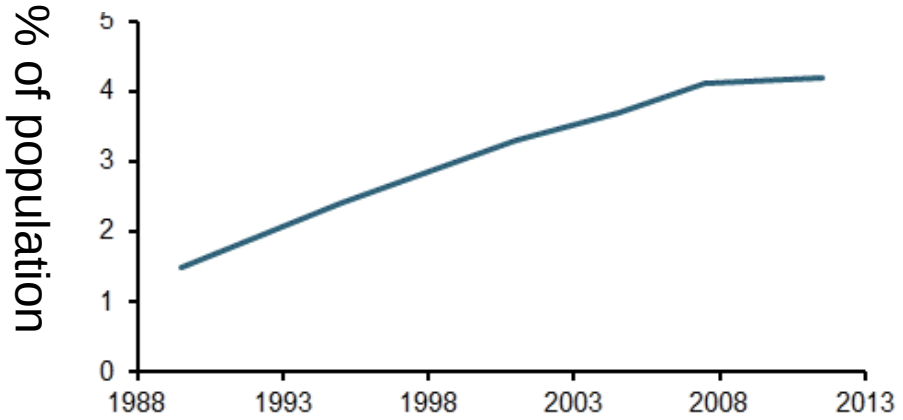
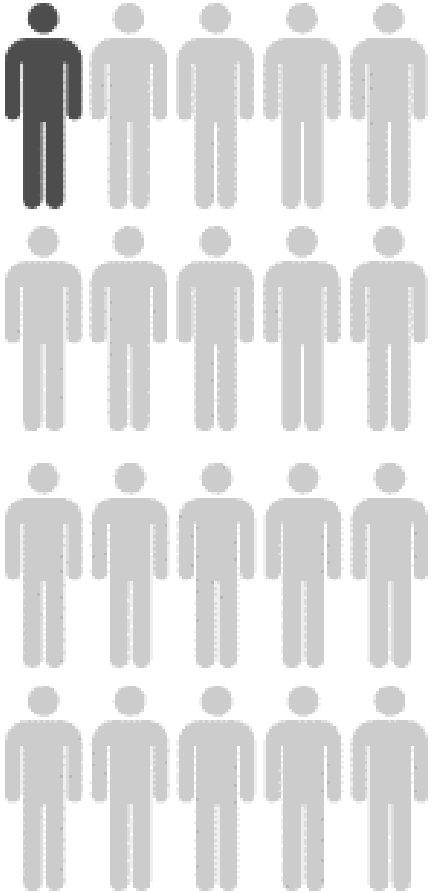
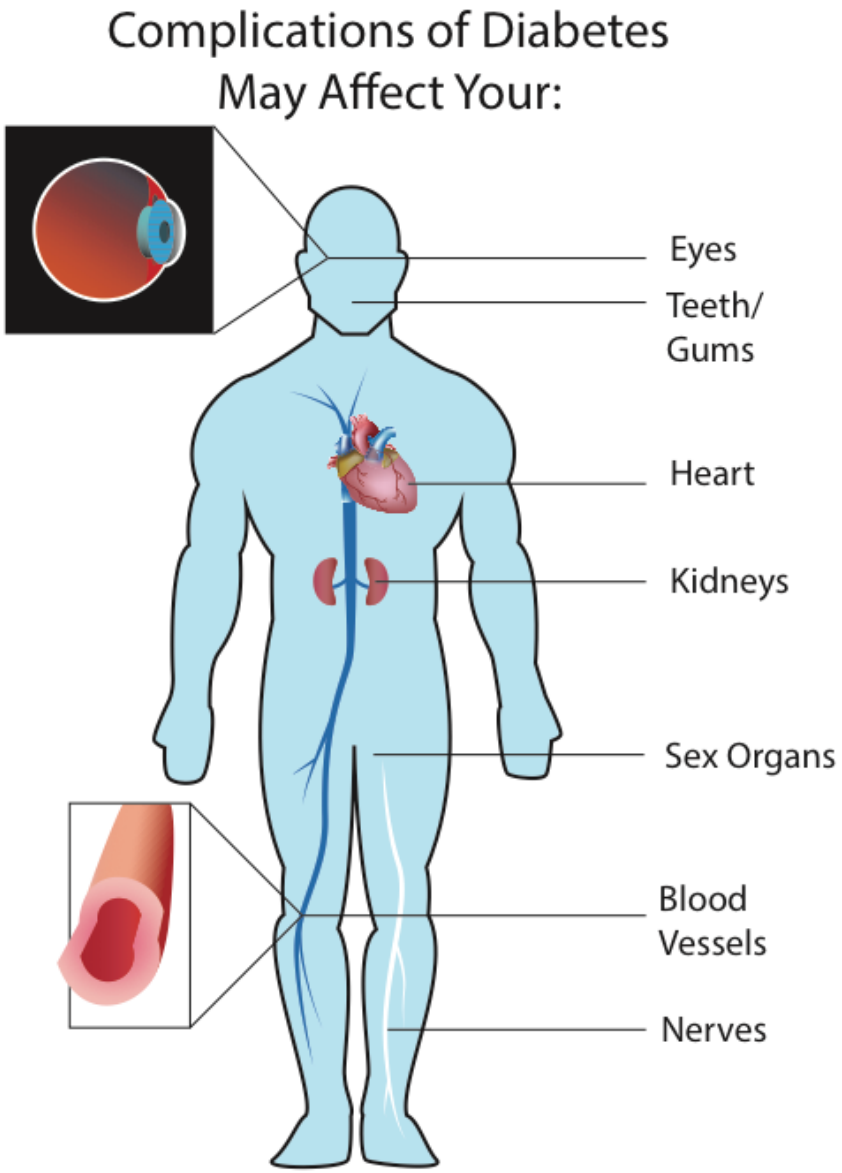
Diabetes in Australia





Blood glucose and diabetes

- Type 2 diabetes brain health impacts:
  - Depression
  - Dementia
  - **Cognitive decline**
- Even high blood glucose in the normal range can be harmful



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Higher blood glucose and diabetes

Glucose → Cognition

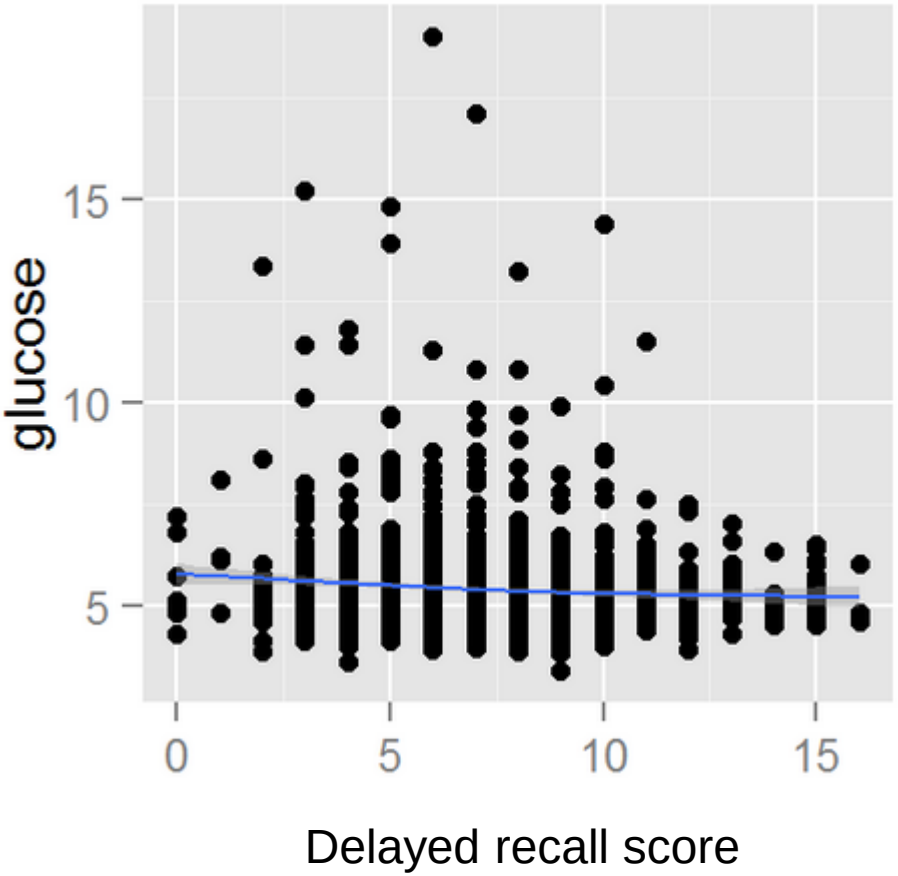
- Effects may differ depending on…

PATH,cohort with blood glucose and cognitive test data: n=429 54% female

– Age (Sims Wright, Levy et al. 2015; Hall, Gonder-Frederick et al. 1989)	40s cohort 3 waves – 45-60
– Diabetic status (Meikle, Riby et al. 2004)	Full blood glucose range: Normal / IFG/ diabetes
– Specific task (Backeström, Eriksson et al. 2015; Foster, Lidder et al. 1998; Feinkohl, Keller et al. 2015)	Three cognitive tasks from different domains

An investigative journey…

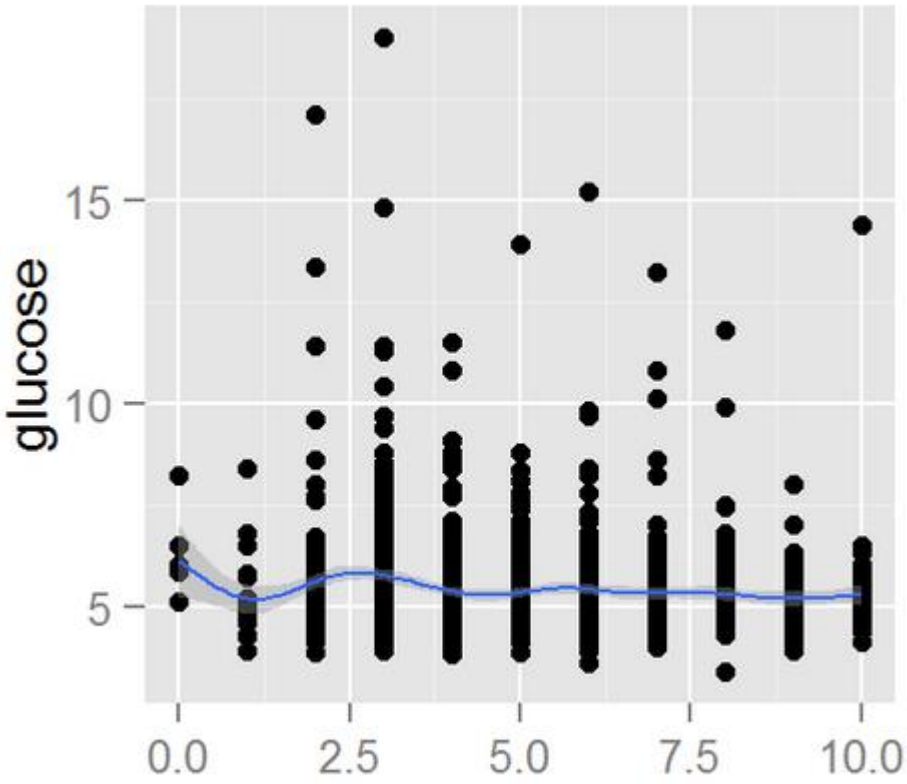
Delayed recall



	Estimate	Sig.
Delayed recall	0.01	0.8

Words selected from the California Verbal Learning Test (Delis, Kramer et al. 1987)

Digits backward

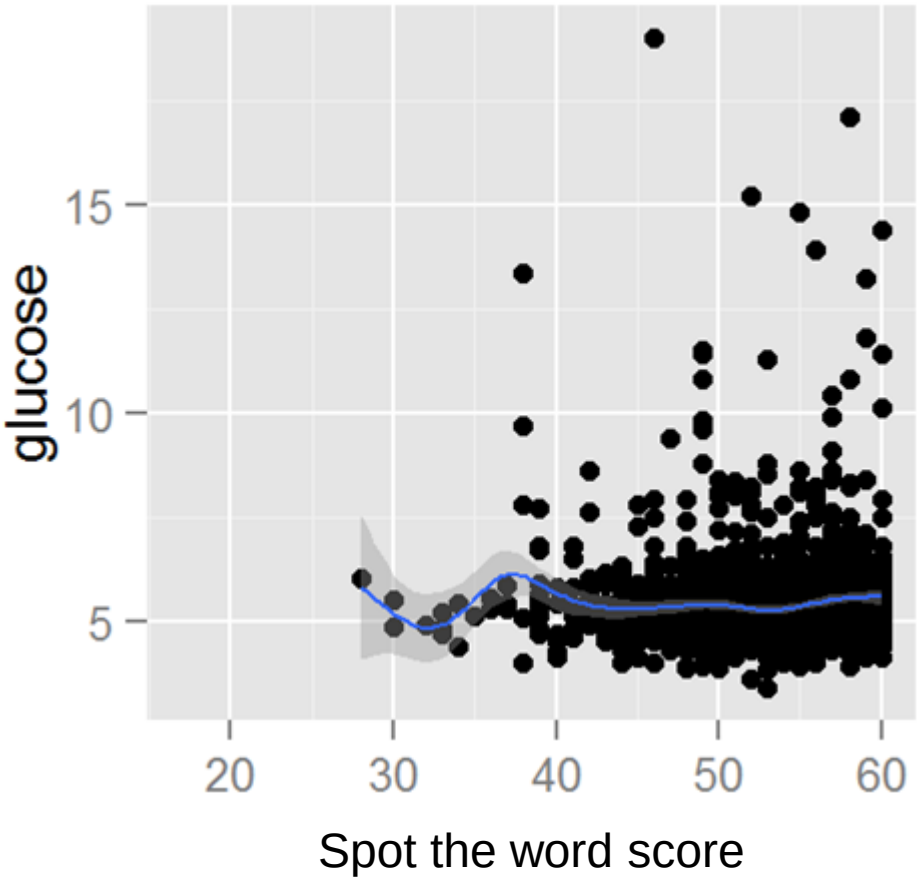


Digits backward score

	Estimate	Sig.
Delayed recall	0.01	0.8
Digits backwards	-0.01	0.79

From the Wechsler Memory Scale (Wechsler 1945)

Spot the word



(Baddeley, Emslie et al. 1992)

Association between blood glucose and cognition differs **by cognitive task.**

	Estimate	Sig.
Delayed recall	0.01	0.8
Digits backwards	-0.01	0.79
Spot the word	0.23	0.01

For each increase in blood glucose of approximately 4mmol/L, participants correctly identified one additional non-word.

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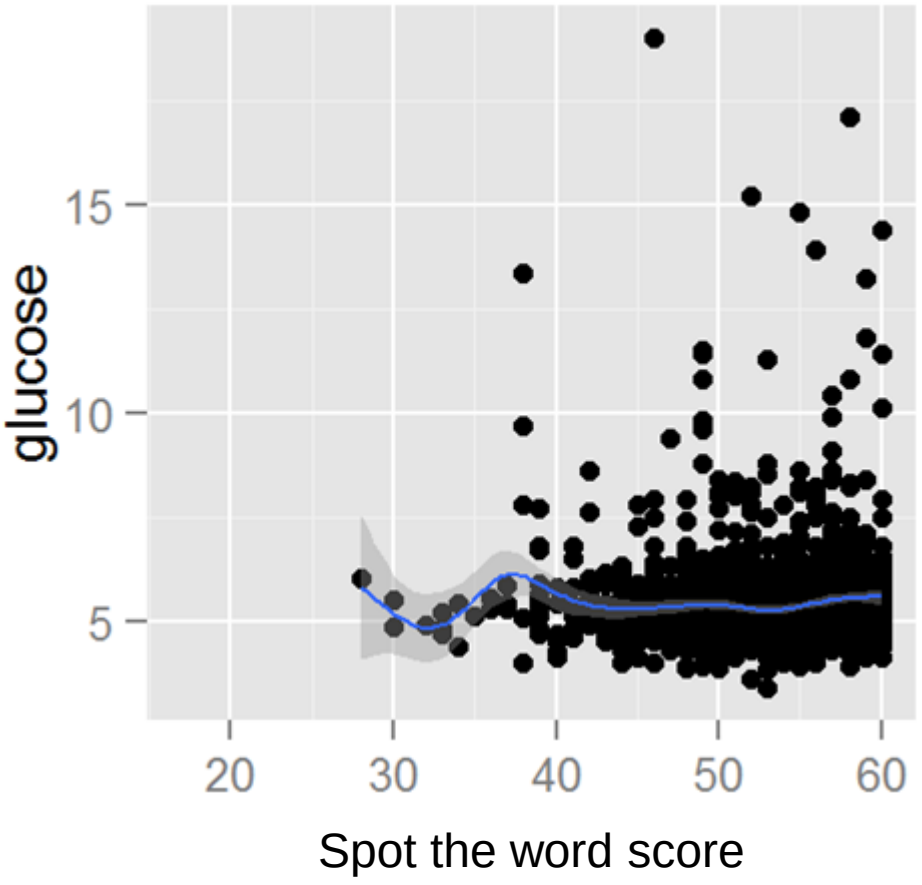
Questions raised

- Why no decrease in performance any cognitive task?
  - Tasks too easy
  - Inappropriate choice
  - Sample too young

- Why an *increase* in performance in Spot-The-Word?
  - Task relies on verbal IQ (which increases with age)
  - Short term glucose facilitation

- Why *just* spot the word?
  - Glucose facilitation greatest for **verbal memory tasks**
    - Delayed recall and digits backwards more about short term memory
    - SDMT more about symbol correspondence

Spot the word

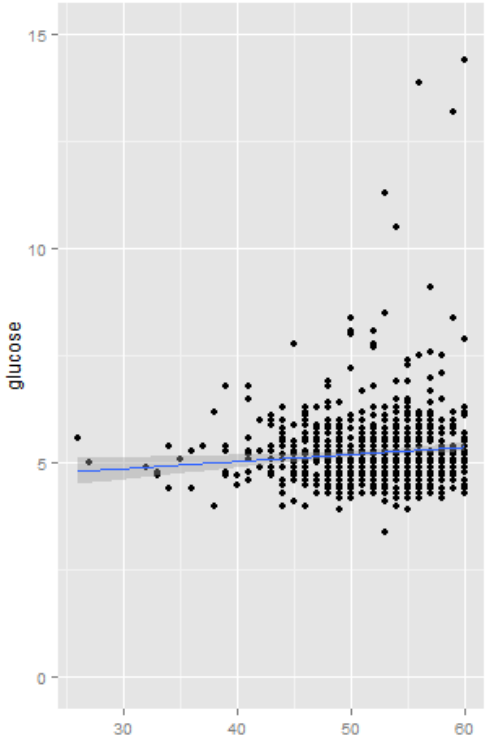


(Baddeley, Emslie et al. 1992)

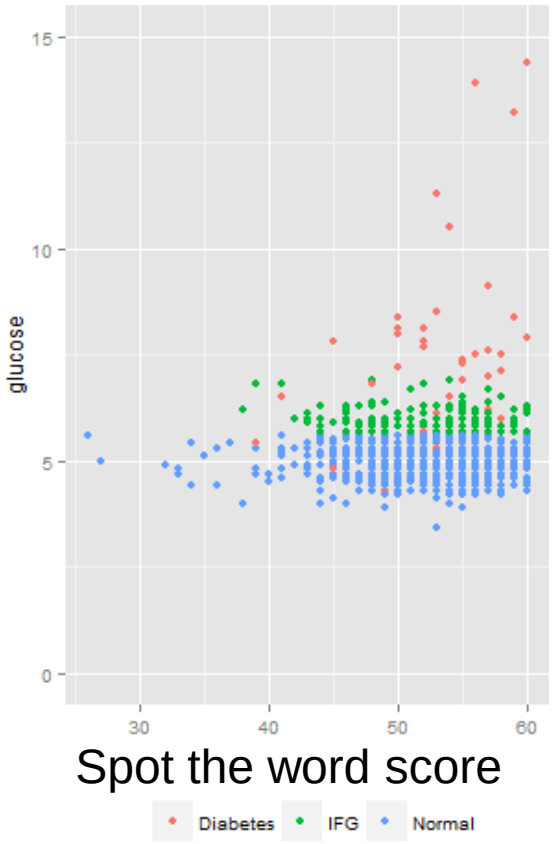
Association between blood glucose and cognition differs **by cognitive task.**

	Estimate	Sig.
SDMT	-0.13	0.45
Delayed recall	0.01	0.8
Digits backwards	-0.01	0.79
Spot the word	0.23	0.01

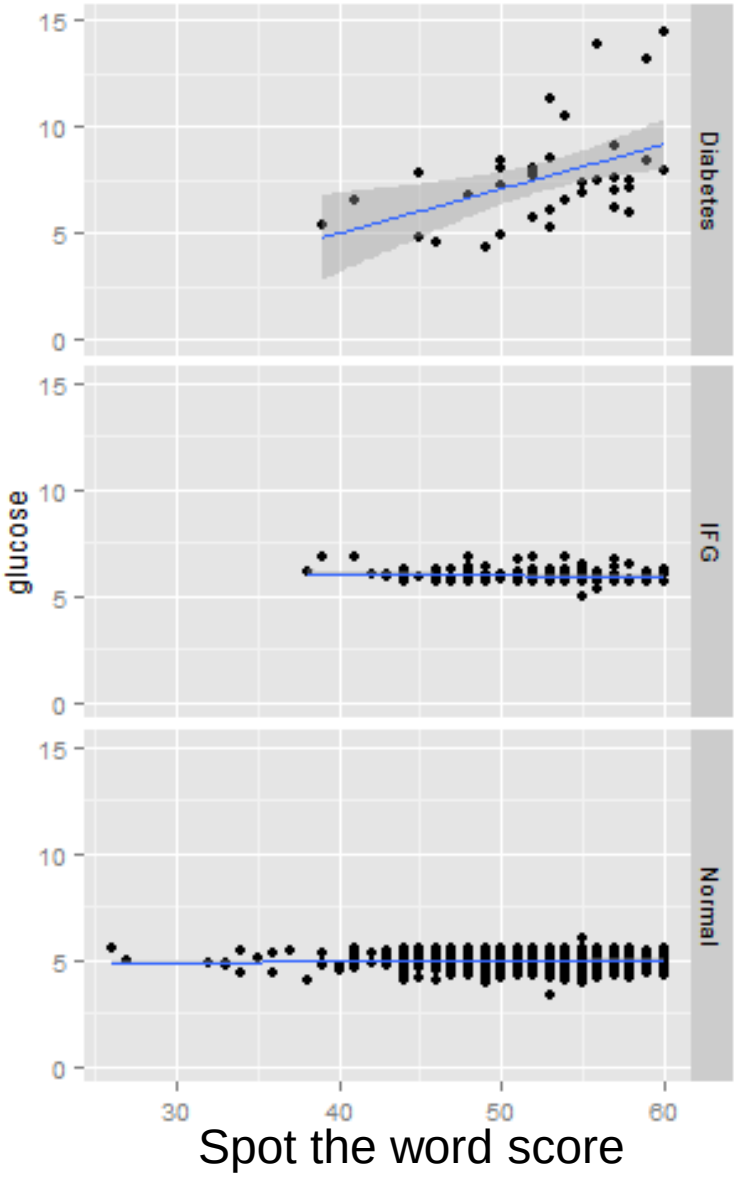
	Estimate	Sig.
Diabetics only	0.31	<0.01
IFG only	-0.03	0.93
Normal only	0.2	0.4



Spot the word score



Spot the word score



Spot the word score

Association between blood glucose and cognition differs **by diabetic status.**

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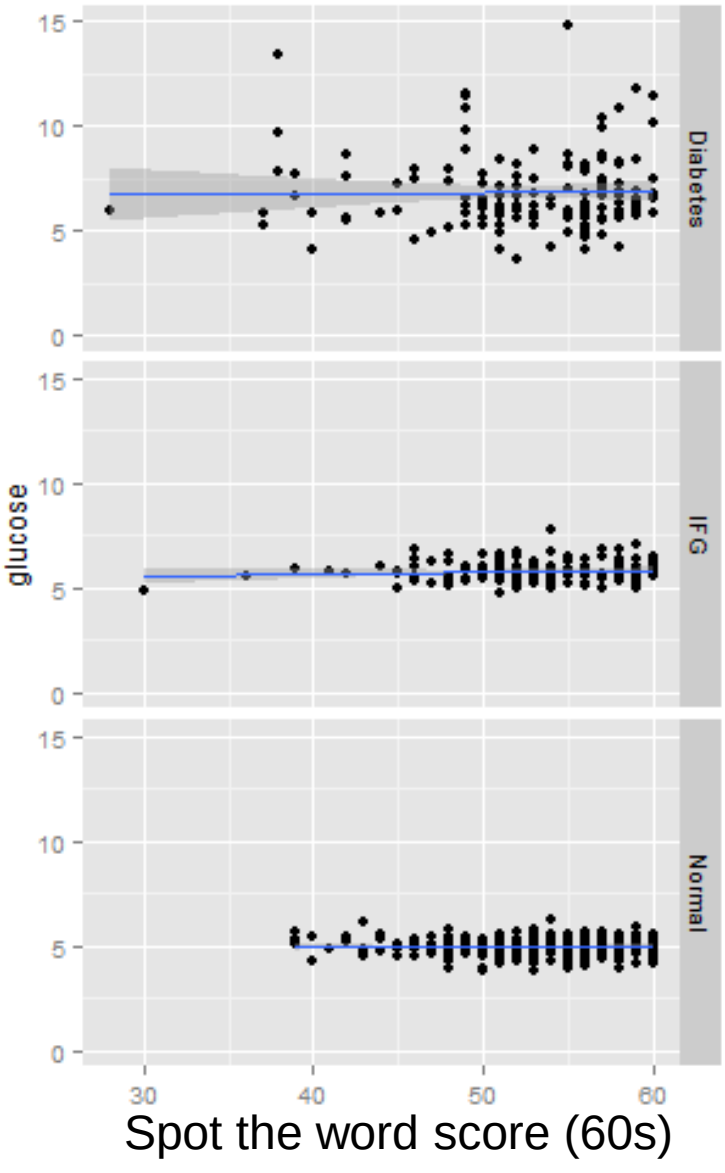
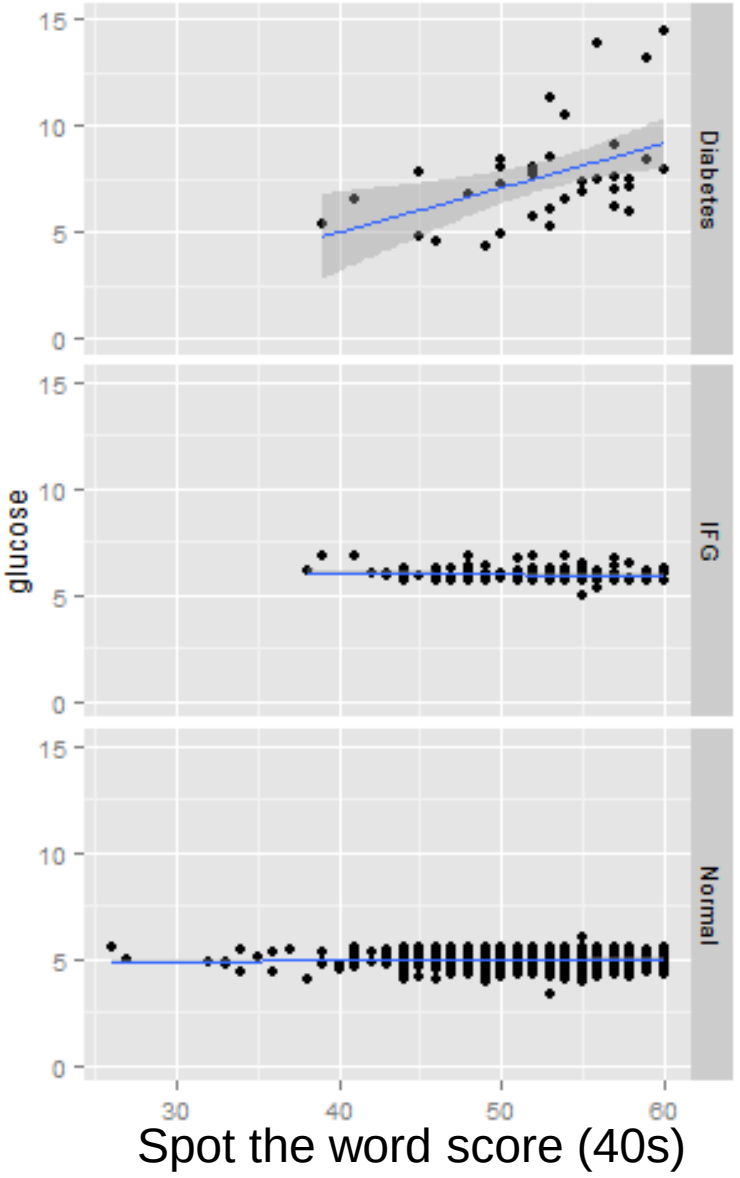
Association between blood glucose and cognition differs **by age.**





60s cohort *n*=357, aged 60 at recruitment, 47% female

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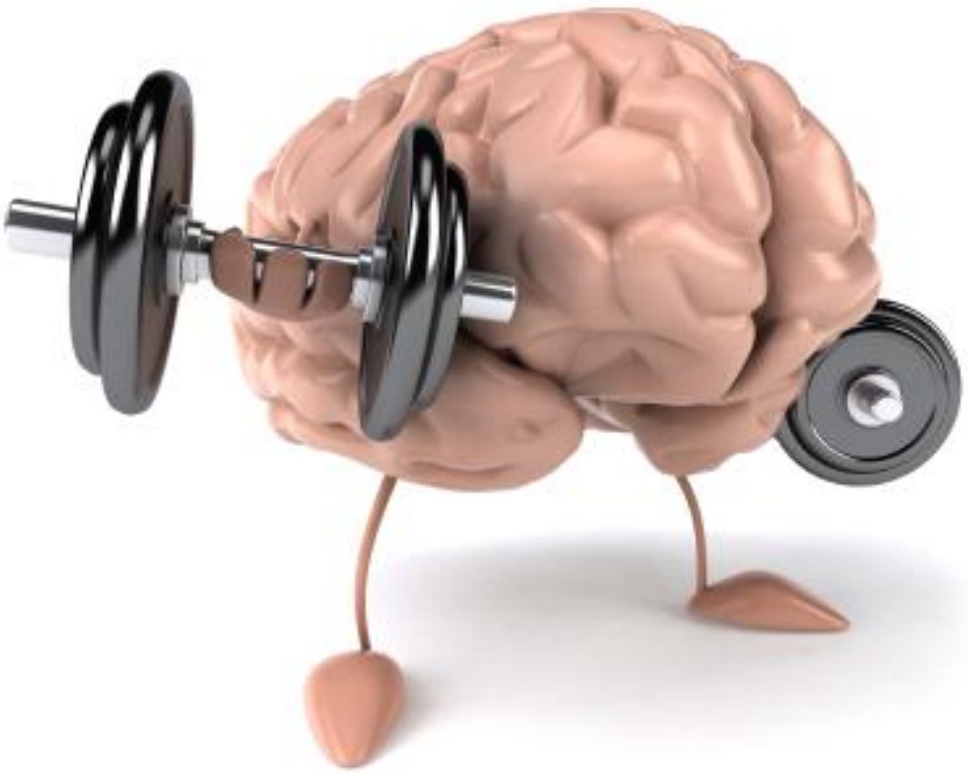
Outlook

- Growing evidence that chronically high blood glucose is associated with poor cognitive outcomes
- Blood glucose is associated with age
- Investigation needs to be sensitive to different effects across tasks, ages and diabetic categories
- **Potential for prevention of one of the contributing factors to cognitive decline in ageing**



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Thank you!

Statistics

	Estimate	Std. Error	t	Sig.	95% CI	
Spot the word	0.23	0.08	2.81	0.01	0.07	0.4
Delayed recall	0.01	0.05	0.26	0.8	-0.09	0.12
Digits backwards	-0.01	0.05	-0.26	0.79	-0.11	0.09

Spot the word

	Estimate	Std. Error	t	Sig.	95% CI	
Diabetics only	0.31	0.1	3.04	<0.01	0.11	0.52
IFG only	-0.03	0.34	-0.09	0.93	-0.69	0.63
Normal only	0.2	0.24	0.85	0.4	-0.26	0.66

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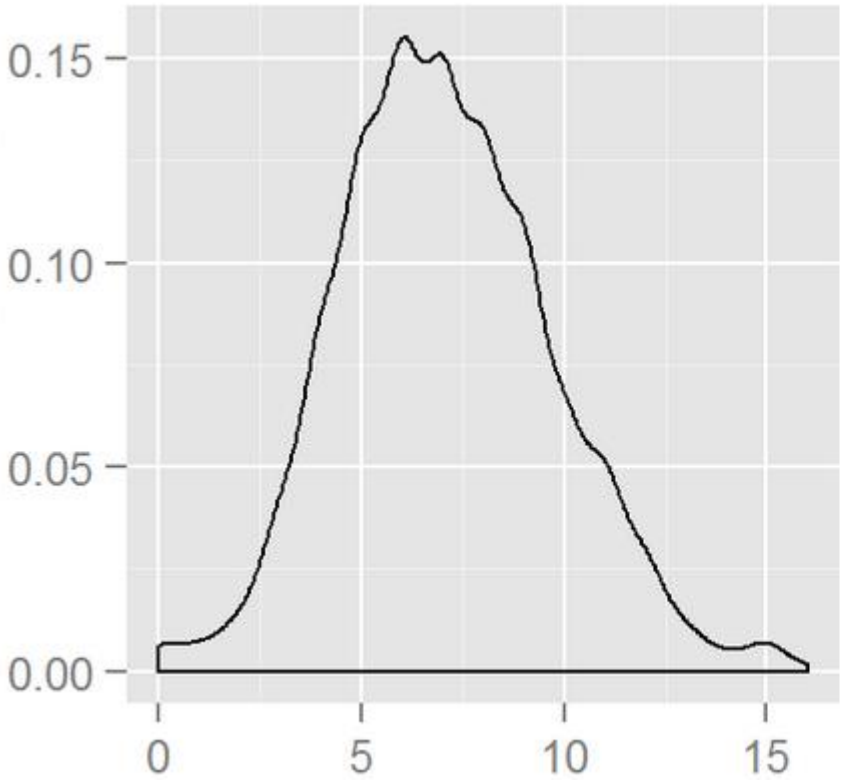
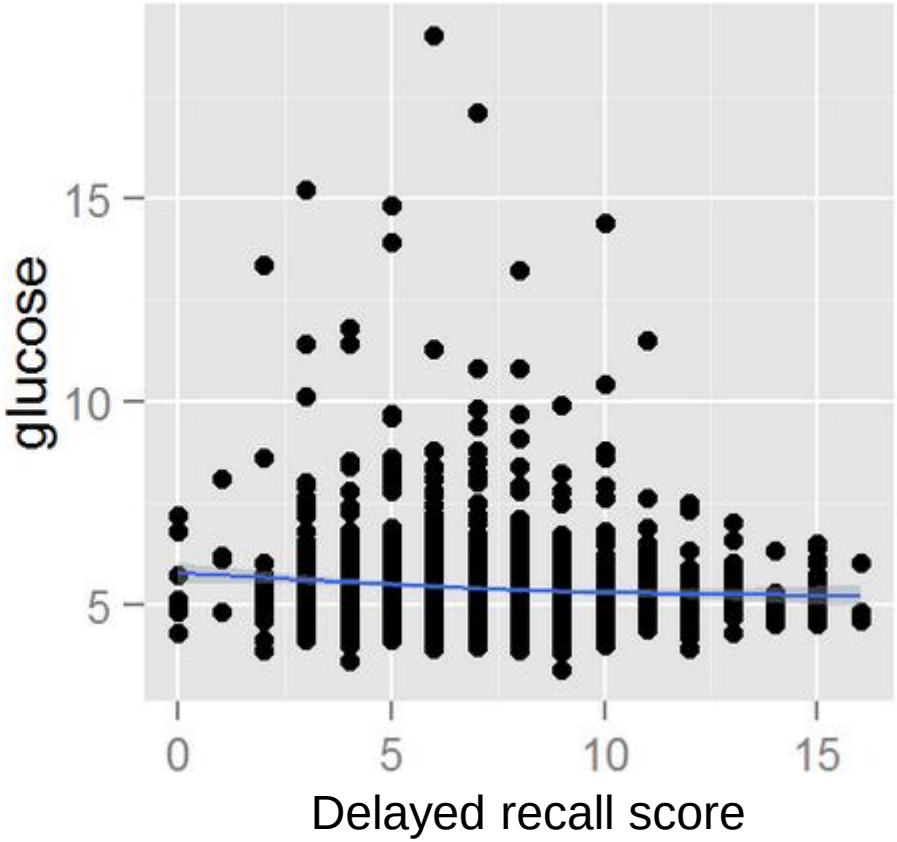
Delayed recall





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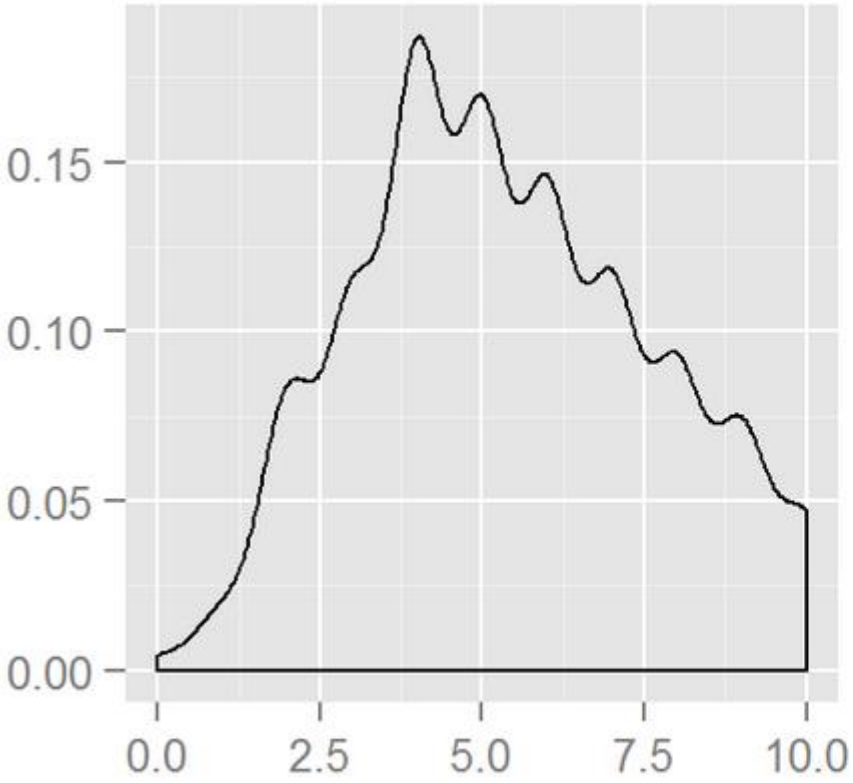

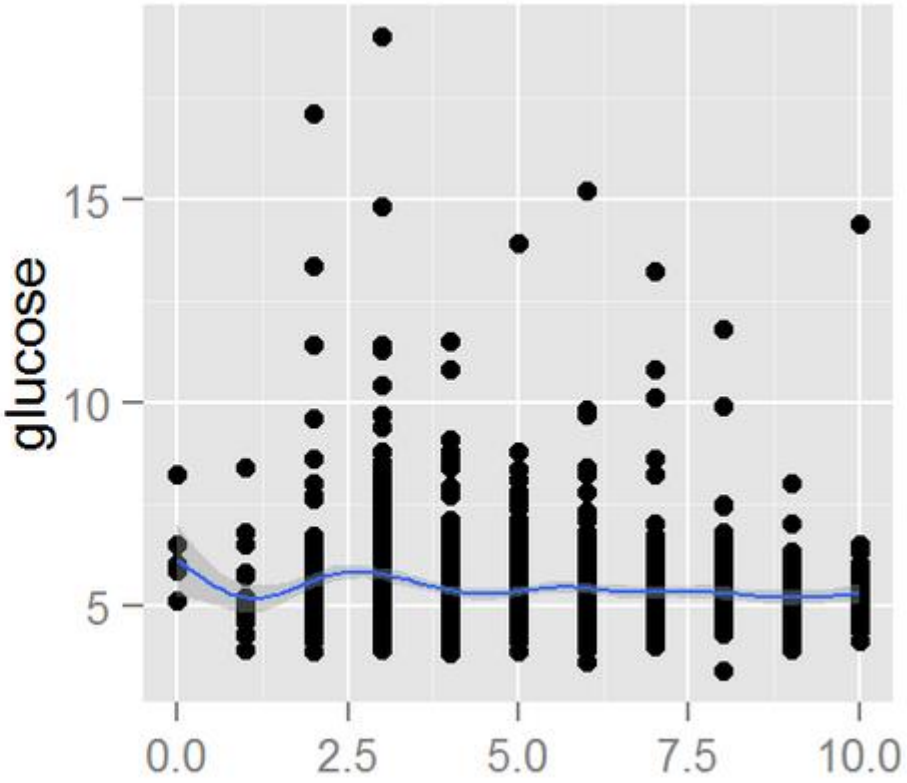

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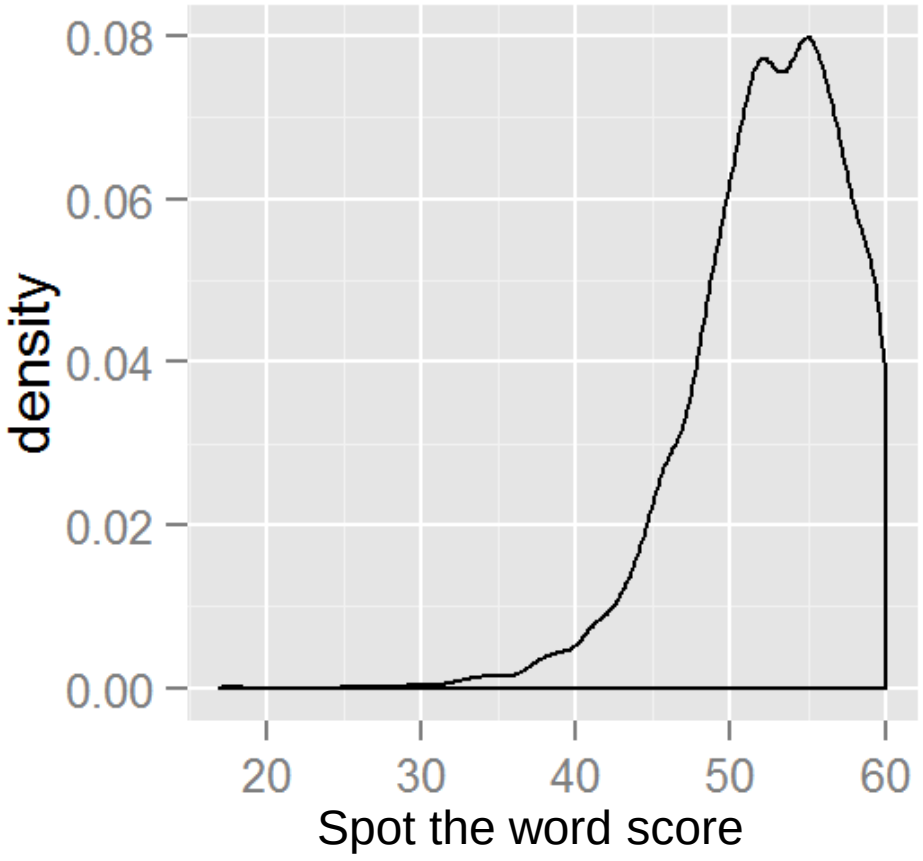

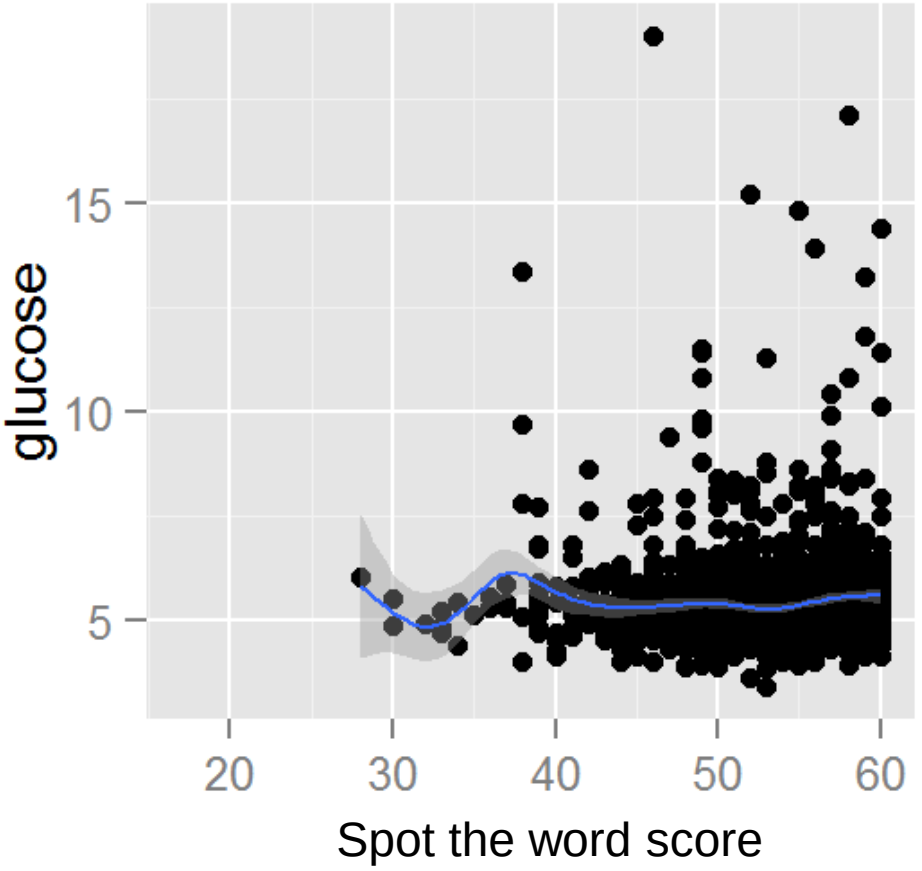

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