



Diabetes Diagnosis 2011

Does your patient have diabetes?

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Case 1:



- A 24 year old stockcar driver presents with:
 - Polyuria
 - Polydipsia
 - Weight loss
 - Glucose of 17 mmol/L
 - Urine ketones positive

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YES INDEED – Probably Type 1



Case 2:



- A 51 yr old Indian woman with presents with:
 - BMI 26
 - Lethargy
 - Random glucose of 13 mmol/L
 - HbA1c 7.3%

Case 2:



- A 51 yr old Indian woman with presents with:
 - BMI 26
 - Lethargy
 - Random glucose of 13 mmol/L
 - HbA1c 7.3%

YES – Probably Type 2

Case 3:

- A 56 year old G.P., asymptomatic, has a routine C.V. screen and has a fasting glucose of 7.1 mmol/L.

Diabetes?



Case 3:

- A 56 year old G.P., asymptomatic, has a routine C.V. screen and has a fasting glucose of 7.1 mmol/L.

Diabetes?

NO – NOT YET

Needs 2 tests abnormal if asymptomatic.

**Recheck with repeat fasting glucose
and/or HbA1c**



Case 4:

- 48 year old obese carpet layer has an oral glucose tolerance following a routine random glucose of 8.1:
 - He has a mild viral infection
 - Fasting glucose is 6.2
 - 2 hour glucose is 11.2
 - HbA1c is 6.2%

Diabetes?



Case 4:

- 48 year old obese carpet layer has an oral glucose tolerance following a routine random glucose of 8.1:
 - He has a mild viral infection
 - Fasting glucose is 6.2
 - 2 hour glucose is 11.2
 - HbA1c is 6.2%

Diabetes?

Again there is one abnormal test and given the variable results from OGTT he needs another confirmatory tests. Beware diagnosing diabetes during an infection.



Case 5:

- A 68 year old builder presents with a chest pain. Random glucose 10.4. HbA1c is ordered

Diabetes?



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- A 68 year old builder presents with a chest pain. Random glucose 10.4. HbA1c is ordered

Diabetes?

HbA1c is 6.8% so he most likely has diabetes: BUT a confirmatory test is needed.



Case 6:



- A 48 year old ACT politician presents with a past history of:
 - T2DM
 - Hypertension
 - Is now 1 year after Roux-en-Y bariatric surgery
- She has fasting glucose of 5.5
 - HbA1c 5.8% off all medication.

Does she still have diabetes?

How do we label her?

Case 7:

- 70 year old woman with Polymyalgia Rheumatica on Prednisone 7.5 mg/d has a blood glucose of 13 pre-lunch. A repeat fasting glucose is 6.4 mmol/L.



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Steroid induced diabetes.

Often fasting glucose on once/day prednisone is normal, but glucose rises during the day. When prednisone is stopped she may have normal glucose tolerance or IGT.



What are the implications of having diabetes as diagnosis rather than IGT / IFG ?



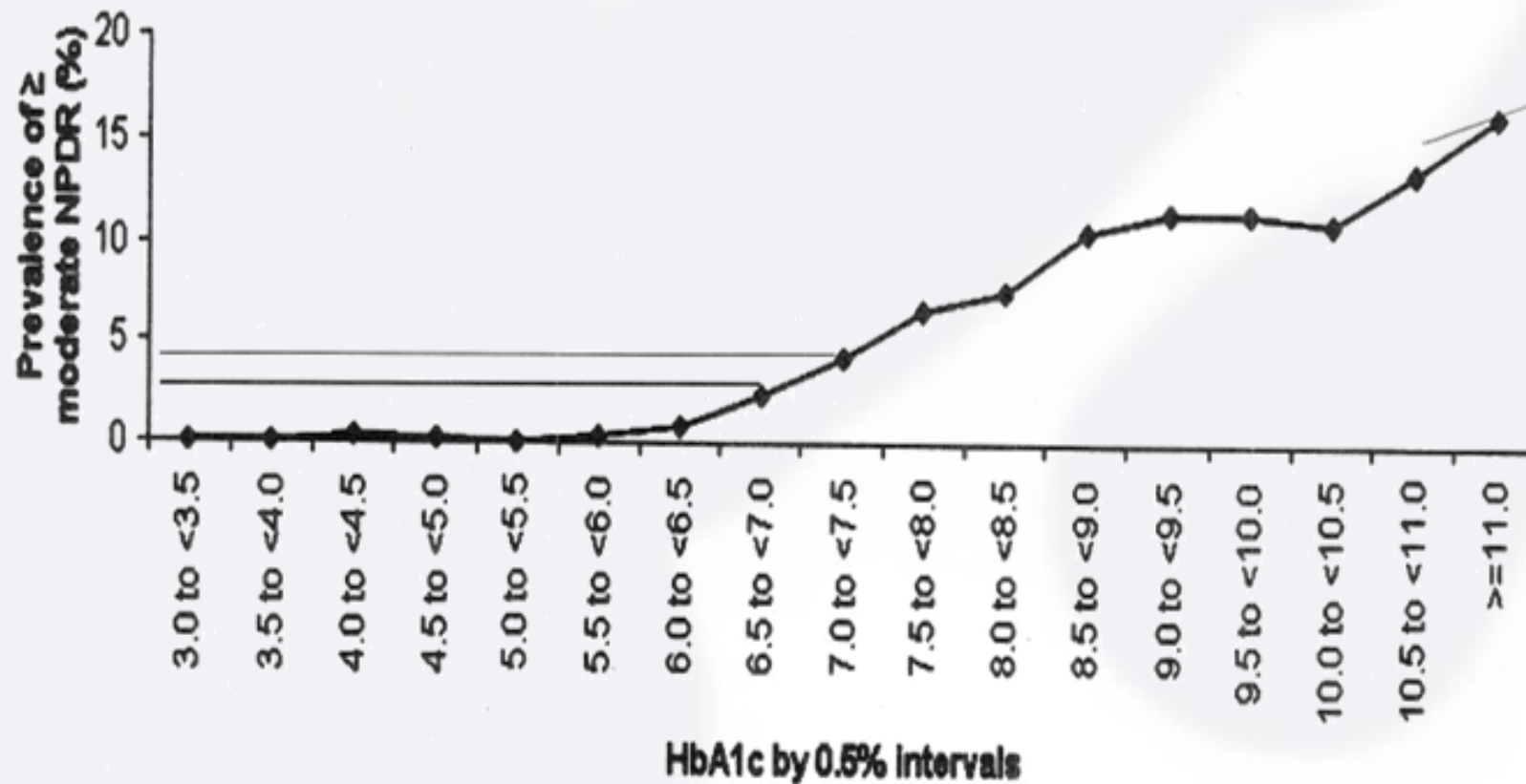
Diabetes	IGT / IFG “Pre-Diabetes”
• Chronic Care programmes • Education: DSME / Dietitian • Medication: Possible Metformin • CV Risk: aggressive review of CV risk • Complication screening: Retinal screening; ACR • Patient issues: Psychological issues – Despondency – Motivation issues • Other costs: insurance issues; more GP visits • Family screening.	• Despite significant macro-vascular risk less likely to be given same lifestyle advice and aggressive CV risk management. • Considered “less serious” • Less frequently followed up

**Historically diagnosis of
Diabetes has depended on
correlation with Retinopathy**

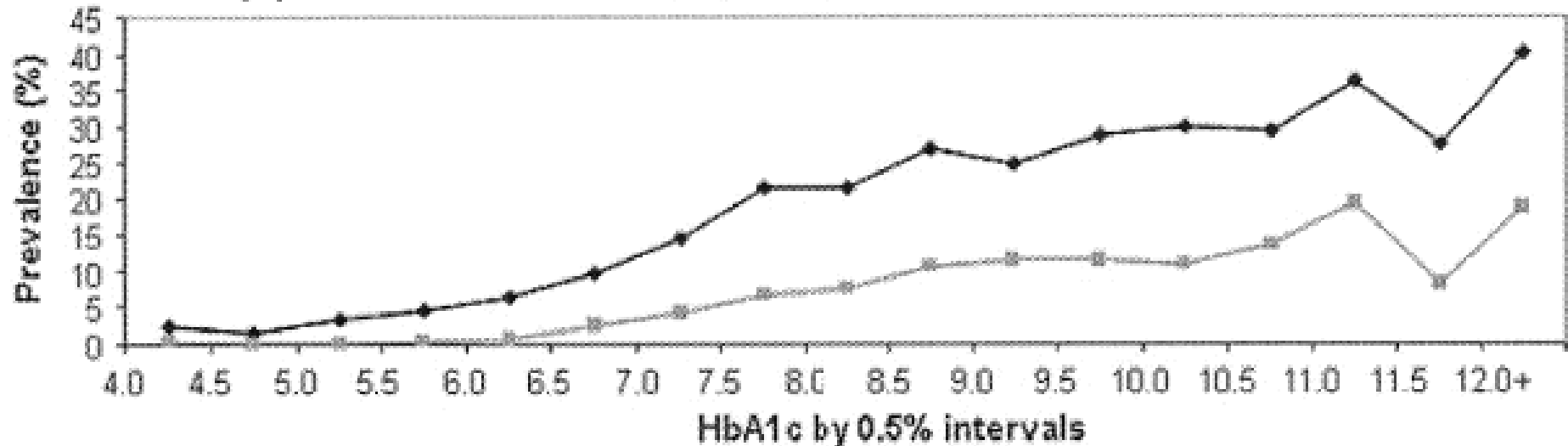
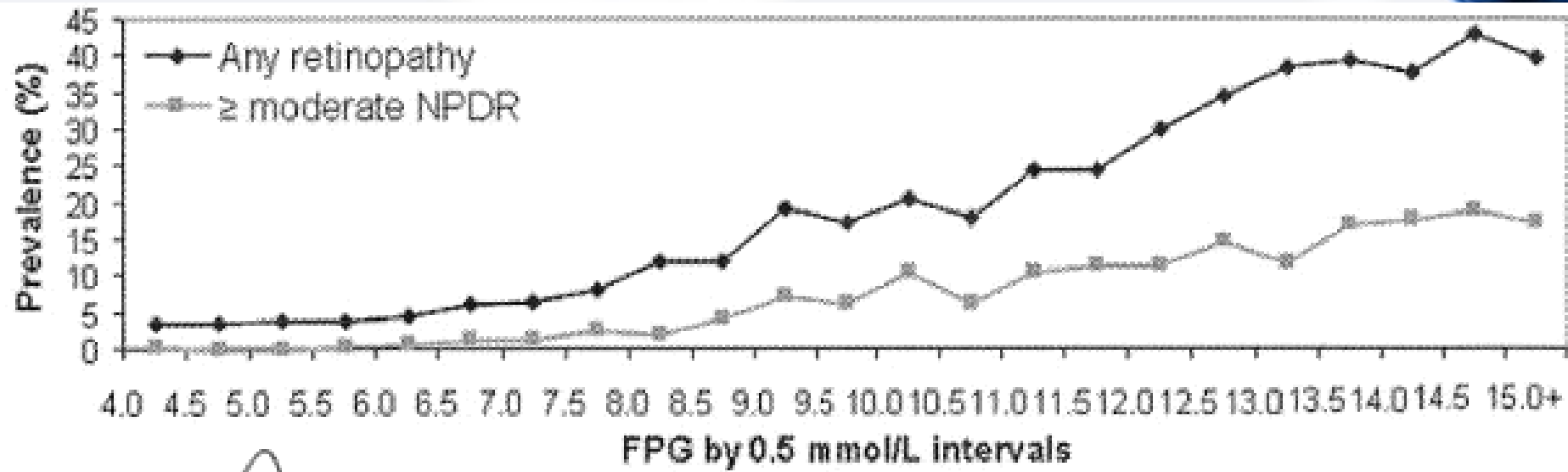


HbA1c & Retinopathy

n = 28000 from nine countries



Prevalence of retinopathy by 0.5 mmol/L intervals for FPG and by 0.5% intervals for HbA1c for any retinopathy and diabetes-specific retinopathy ($\geq$ moderate NPDR) from DETECT-2

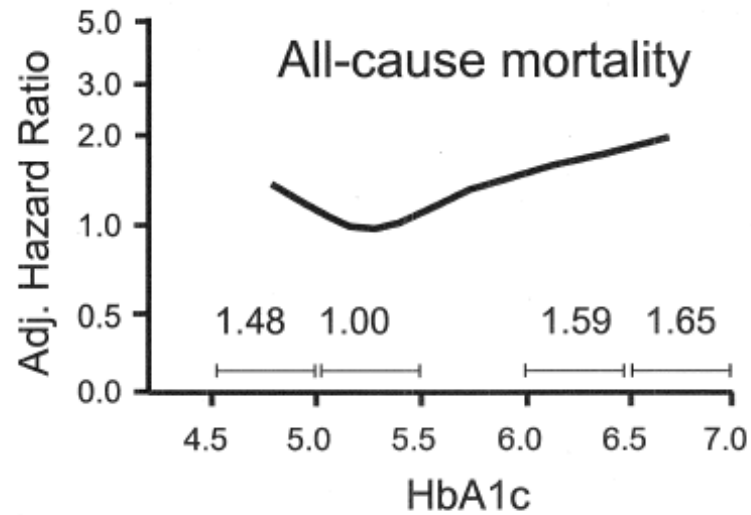
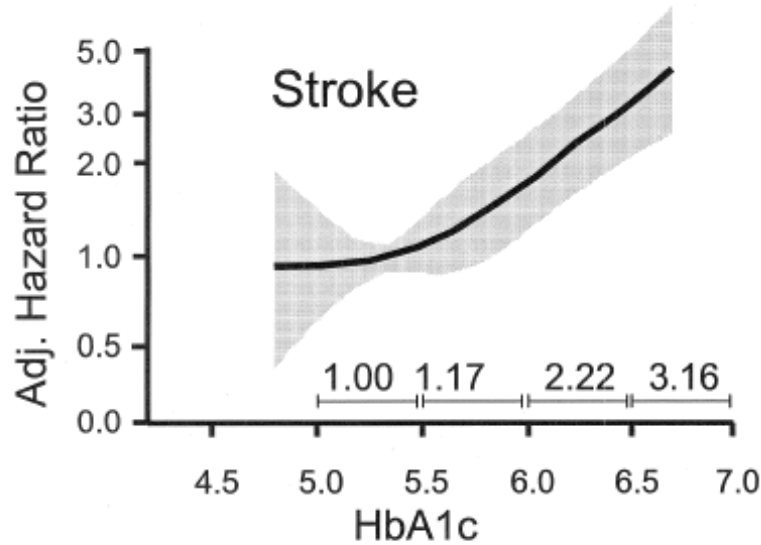
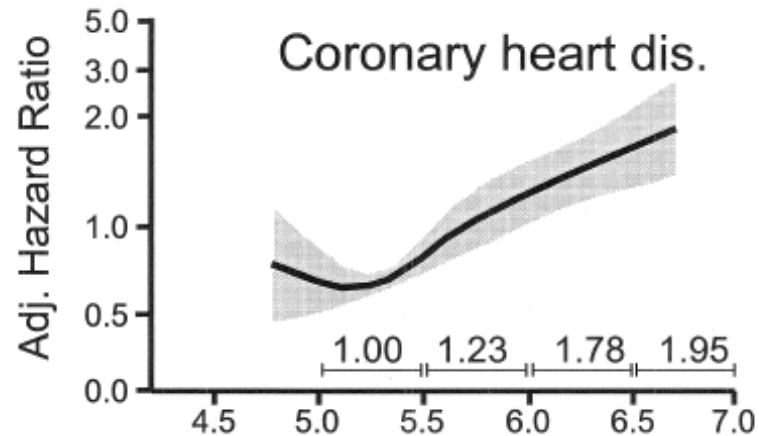
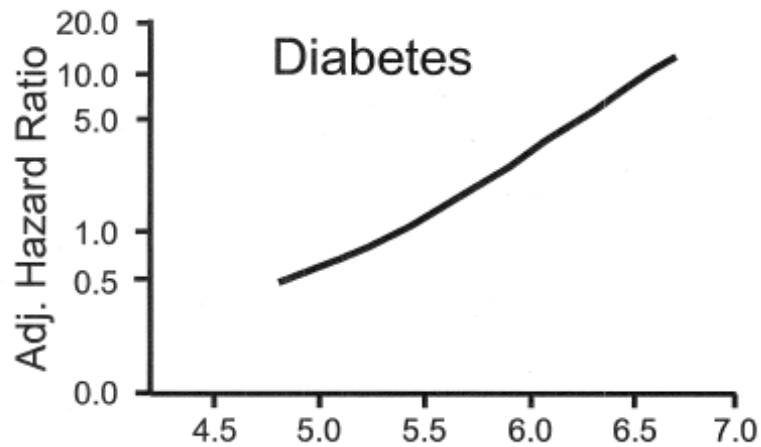


C/V Risk & HbA1c



- C/V risk increases with increasing level of glucose like BP, Cholesterol.
- A cut off point below which the risk of diabetes related complications is zero is very difficult to determine.

HbA1c & Long-Term Risk (ARIC Study)



(Selvin, NEMJ 2010; 800-11)

Problem with fasting glucose



- Most people do not fast. Intra-individual variables with CV of 12-15%.
- Some with non-diagnostic fasting will have diabetes on OGTT ? 1 in 3
- Methodology issues:
 - Early spin (within 30 min) leads to higher levels
 - Use of fluoride to slow glucose fall (from continuous cell use of glucose) after 1st 1-2 hours.

Problems with OGTT



- Inconvenient
- Time
- Cost
- Reproducibility issues
- Should glucose load be correlated with weight?

Reproducibility of Diabetes Tests



Measurement	C.V. _i (within person)	95% limits of agreement (2 wks apart)	Likelihood of second high results (+2wks)
Fasting glucose	5.7%	± 0.9 mmol/L	70% ≥ 7.0 mM 78% ≥ 6.1 mM
2hr glucose	17%	± 3.1 mmol/L	72% ≥ 11.1 mM 72% ≥ 7.8 mM
HbA1c	3.6%	± 0.5 %	83% ≥ 6.5 % 89% ≥ 6.1 % 100% ≥ 7.0 %

PROS for using HbA1c as Diagnostic Test



- Less variability in assay c.f. glucose
- Less day to day variability ($< 2\%$ mostly)
- No need for fasting or early morning test
- In short term no effect of stresses, infection; exercise; lifestyle changes;
- Reflects longer term glycaemia
- Correlates well with micro and macro-vascular complications
- Use guides treatment
- Doctor familiarity

CONS for using HbA1c as Diagnostic Test



- May be altered by red cell life span
- Individual glycation differences – genetic; ethnic;
- May be altered in condition like iron deficiency
- Not available in Labs in some area of world
- Cost

What can cause an increase in HbA1c other than glucose?



- Certain ethnicities? African-American
- ? Age
- Iron deficiency
- Abnormal haemoglobin
- Splenectomy
- B12 deficiency
- Alcoholism
- Severe Uraemia
- Very high triglyceride

What can cause a decrease in HbA1c other than low glucose ?

- ↑ Red Blood Cell turnover
e.g. haemolysis; acute bleeding;



Will diabetes prevalence change if HbA1c is used for diagnosis?



- HbA1c will identify a slight different group of people with diabetes than current criteria
- ? If use HbA1c alone, may end up with fewer labelled with diabetes

Use of HbA1c in NZ shows that many without diabetes are being tested: MOH data



Diabetes	Number of Tests in Year				
	1	2	3	4	5
No	107,703	15,366	3,512	1,366	495
Yes	39,657	32,234	19,002	11,116	6,295
All	147,360	47,600	22,514	12,482	6,790

HbA1c – New Units

How do old and new relate?



DCCT-HbA1c (%)	IFCC-HbA1c (mmol/mol)
6.0	42
6.5	48
7.0	53
7.5	59
8.0	64
9.0	75



Cut points vary depending on diabetes prevalence



HbA1c:

- $\leq 5.5\%$ (36 mmol/mol) = No Diabetes
- or
- $\geq 7\%$ (53 mmol/mol) = Diabetes
- Has 97.5% NPV or PPV for diabetes using OGTT as reference

Diabetes Care 2010;33;817-819

Current ADA Criteria for Diabetes Diagnosis



- With symptoms
plus
 - Random glucose > 11.1
- or**
- F.P. glucose > 7.0

Current ADA Criteria for Diagnosis of Diabetes No Symptoms



- FPG ≥ 7.0 mmol/L
- or
- 2 hour OGTT ≥ 11.1
- or
- Random glucose ≥ 11.1
- or
- HbA1c $\geq 6.5\%$
- With repeat test if discordant or no symptoms. Exactly when?

ADA Criteria



- If discordant results, repeat the test that is above the threshold for a final diagnosis.
- If the repeat is discordant, wait 3-6 months and repeat again.
- Lifestyle intervention if HbA1c 6-6.4%

A blue stethoscope is positioned in the top right corner of the slide, partially overlapping the dark blue background and the white paper area.

Diagnosis of Diabetes Suggested Criteria for New Zealand

- Yet to be ratified by NZSSD



- HbA1c ≥ 50 mmol/mol (6.7%) to be used as diagnostic equivalent
- If Asymptomatic, a second HbA1c at 2 months after initial test though HbA1c of 53 (7%) or above will almost certainly rule in diabetes



- If patient symptomatic use current glucose criteria:
 - Fasting glucose > 7.0
 - Random glucose > 11.1
- If criteria met proceed to full C/V risk assessment and management including micro-vascular screening (retinopathy, ACR).
- If uncertainty use current glucose criteria



- If HbA1c 40-49: dysglycaemic or borderline glucose tolerance
 - give lifestyle advice
 - full C/V assessment and management
 - repeat HbA1c 1 year.
- If HbA1c < 40:
 - Simply repeat at next C/V assessment at ? 3-5 years



HbA1c Result	Conclusion	Actions and Repeat Interval
Less than 40 mmol/mol [<5.8%]	Not diabetic	● Address overall CV risk ● Repeat only when CV risk screening next due
40 – 49 mmol/mol [5.8-6.6%]	Dysglyceamia	● Intensive diet and lifestyle management ● Address overall CV risk ● Repeat HbA1c in 1 year
50 mmol/mol or greater [≥6.7%]	Diabetes if confirmed*	● Repeat after at least 2 months ● If confirmed treat and screen ● Address overall CV risk

N.B.: * Symptomatic patients should be assessed using current glucose criteria and clinical judgement. If unambiguously symptomatic and with a clearly abnormal glucose they do not require a repeat test.



*Thank you for
your attention*