

# Practicalities of blood glucose monitoring with multiple dose injections

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# Declarations

I have received honoraria from the following companies:

- ❖ Napp
- ❖ NovoNordisk
- ❖ GlucoRx
- ❖ AgaMatrix
- ❖ BD
- ❖ Abbott

# What is blood glucose monitoring?

**SMBG** - self monitoring blood glucose

**CBG** – capillary blood glucose

**BGL** – blood glucose level

**FBG**- fasting blood glucose

**PPG**- post-prandial glucose

.....**NOT** a ‘BM’



“SMBG has been described as possibly the most important advance in controlling diabetes since the discovery of insulin” (Tonyushkina and Nichols, 2009)

“Blood glucose monitoring is a way of testing the concentration of glucose in the blood (glycemia)”

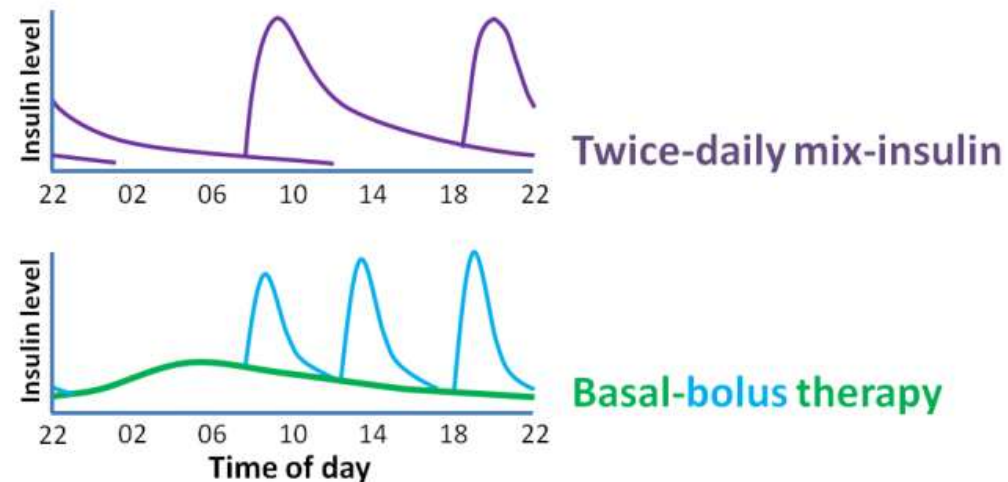
“a blood glucose test is typically performed by piercing the skin (typically, on the finger) to draw blood, then applying the blood to a chemically active disposable 'test-strip.'”

## What is Multiple Dose Injection (MDI) ?

Multiple dose injection (MDI) therapy, also known as multiple daily injections, is an alternative term for the basal/bolus regime of injecting insulin.

The therapy involves injecting a long acting insulin once or twice daily as a background (basal) dose and having further injections of rapid acting insulin at each meal time.

Multiple daily injection therapy can involve 2+ injections today



## SMBG facts & figures...

- Over 40 different blood glucose testing strips for use with a wide range of meters available on Fp10
- Dependant on local formularies
- Take only a few seconds to deliver a BG result with a small drop of capillary blood
- Given by diabetes team – should not be bought by patients
- £186.6 million was spent on diagnostics and monitoring devices in England between 2015 and 2016 (NHS Digital, 2016)

# Blood glucose meter choice



# Who should test?

## 1. Safety:

- Identify hypoglycaemia in people using insulin & Sulfonyureas
- Confirm safety to drive
- To optimise glycaemic control in women planning or during pregnancy
- To inform management of intercurrent illness (HHS or DKA)
- Avoid unplanned admission to hospital
- Reduce risk of hypoglycaemia (Ramadan)



## 2. Empowering lifestyle changes:

Objective feedback to the person with diabetes about the success or otherwise of lifestyle changes such as dietary modification & increased activity, as well as effectiveness of their medication dose.



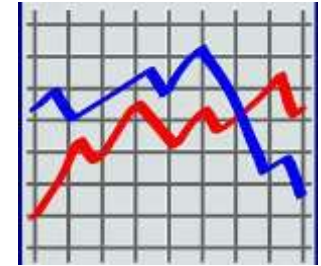
## 3. Special circumstances:

- steroid use
- antipsychotic medication - JBDS-IP 2014 guideline Management of hyperglycaemia and steroid (glucocorticoid) therapy



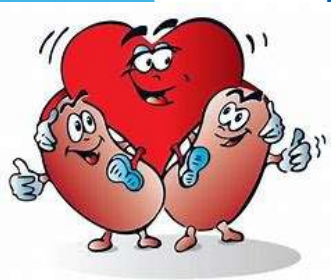
#### 4. Supporting decision making:

Can provide data to support people with diabetes and their HCPs in providing tailored advice for individuals with diabetes about lifestyle and meds



#### 5. Reducing complications:

Reduction of costly acute and long-term complications may be achieved if SMBG is used to make behavioural changes, and make effective use of medication – people potentially more likely to take meds if can see results?.



# So what guidance do we have?

- NICE – type 1 and 2 guidelines
- Scottish Intercollegiate Guidance Network (SIGN)
- DVLA
- International Diabetes Federation (IDF)
- Diabetes UK
- Association for British Clinical Diabetologists (ABCD)
- TREND- UK



## NICE – type 1

Advise routine SMBG for all adults with type 1 diabetes, and recommend testing at least 4 times a day, including before each meal and before bed

Support to test up to **10 times a day** if any of the following apply:

- The desired target for blood glucose control measured by HbA1c is not achieved
- The frequency of hypoglycaemia episodes increases
- In relation to driving as per DVLA requirements
- During periods of illness
- Before, during and after sport
- When planning pregnancy, during pregnancy and while breastfeeding
- If there is a need to know blood glucose levels more than 4 times a day for other reasons (e.g. impaired awareness of hypoglycaemia, high-risk activities)

(NICE NG17, 2015a)

## NICE – type 2

Self-monitoring of plasma glucose should be offered if:

- The person is on insulin
- There is evidence of hypoglycaemic episodes
- On oral medication that may increase their risk of hypoglycaemia while driving or operating machinery
- Is pregnant or planning a pregnancy
- Starting treatment with oral or intravenous corticosteroids

Assess annually in a structured way:

- Self-monitoring skills
- The quality and appropriate frequency of testing
- The use made of the results obtained
- The impact on quality of life
- The continued benefit
- The equipment used

(NICE NG28, 2015b)

## Scottish Intercollegiate Network - (SIGN)

- SMBG is recommended for patients with T1&2 who are using insulin where patients have been educated in appropriate alterations in insulin dose
- Routine SMBG in people with type 2 diabetes who are using oral glucose lowering drugs (with the exception of Su's) is not recommended
- Motivated patients with T2 using Su's may benefit from routine use of SMBG to reduce risk of hypoglycaemia
- SMBG may be considered in the following groups of patients who are not using insulin: those at increased risk of:
  - hypoglycaemia,
  - those experiencing acute illness,
  - those undergoing significant changes in pharmacotherapy,
  - those fasting (e.g. during Ramadan),
  - those with unstable or poor glycaemic control (e.g. HbA1c >64)
  - women during or planning pregnancy

(SIGN 116, 2014)

# DVLA guidance

| Treatment                               | Class 1                                                                                                                                                                                                                      | Class 2                                                                                                                                                                                                                                                                         |
|-----------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Diet alone                              | -                                                                                                                                                                                                                            | -                                                                                                                                                                                                                                                                               |
| Tablets/inj with no hypo risk           | -                                                                                                                                                                                                                            | -                                                                                                                                                                                                                                                                               |
| Tablets with hypo risk (Su's, glinides) | It is appropriate to offer SMBG at times relevant to driving to enable the detection of hypoglycaemia                                                                                                                        | Regular SMBG – at least twice daily and at times relevant to driving (e.g. no more than 2hrs before the start of the first journey & every 2 hours while driving)                                                                                                               |
| Insulin                                 | Test blood glucose no more than 2hrs before start of the journey. Test every 2 hours while driving. More frequent SMBG may be required with any greater risk of hypoglycaemia (e.g. physical activity, altered meal routine) | Must store 3 months of readings. Carry out regular BGM at least twice daily on days when not driving. Test no more than 2hrs before start, & every 2hrs while driving. More frequent monitoring may be required with any greater risk of hypoglycaemia (e.g. physical activity, |

# International Diabetes Federation

- SMBG should only be used when the patient has the knowledge and willingness to incorporate SMBG and therapy adjustment into their diabetes care plan in order to attain agreed treatment goals
- It can be used by newly diagnosed patients to enhance their understanding of diabetes as part of their education programme, and to facilitate timely treatment initiation and dose optimisation
- The frequency of SMBG monitoring should be individualised depending on education, behavioural and clinical requirements (i.e. to identify/prevent/manage hyperglycaemia and hypoglycaemia)
- It can also be used where it will provide HCPs with the data to inform therapeutic decisions

(IDF, 2008)

# Diabetes UK alongside ABCD

- Called for removal of blanket denial policies
- Emphasis on SMBG not being a stand alone intervention
- Must be accompanied by education on interpreting the results
- Recommend SMBG availability should be based on individual assessment
- Set out responsibilities for SMBG monitoring: the person with diabetes, the HCP, the pharmacist, the strip manufacturer, and the commissioners of services
- The organisation also provides advice for patients who are finding it difficult to obtain test strips on prescription

(Diabetes UK, 2013b).

## Common themes:

- Must be alongside education
- Individualised
- Reduce risk of hypo
- DVLA regs
- Attain agreed treatment goals
- Safety during pregnancy
- Safety with meds
- Empowerment

## Using SMBG to the best of its ability...

- People with diabetes (and HCPs and carers using BG meters) should know their BG targets and understand what action is required if the result is out of target range (i.e. the detection and correction of hypo and hyperglycaemia)
- Correct user technique is critical
  - Hands should be washed and dried before commencing the procedure
  - BG testing strips should be in date
  - Quality assurance (both internal and external) is mandatory for HCPs (MHRA, 2013)
- Be aware of patients who have abnormalities with haematocrit or interferences that would give inaccurate readings
  - Only specific meters are suitable for patients on peritoneal dialysis, so the HCP needs to check with the manufacturers' guidance

## What is ISO & does it matter?

**ISO** (International Organization for Standardization) describes the requirements for blood glucose monitoring systems using capillary blood

All meters must have met the 2013 ISO standards on:

- Ease of operation, maintenance, cleaning, clear display, safety and reliability, precision, accuracy and influence by abnormalities in haematocrit, user performance evaluation, including ease of understanding instructions

**Although the ISO standards are important, the skill of the user, not the meter, is the most significant source of BG errors, accounting for 91–97% of overall inaccuracies.**

# Haematocrit

Haematocrit affects the fluid content of blood, where the glucose is carried:

- **High** haematocrit (common in chronic respiratory conditions & high triglycerides) can give falsely **low** BG
- Whereas conditions with **low** haematocrit (e.g. pregnancy) can give falsely **high** BG results
- So ensure using ISO checked blood glucose meter & patient has Full blood count

(Tonyushkina and Nichols, 2009)

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## How does BGM help with MDI

- Varying regimens of SMBG – that inform how to adjust MDI regimens
- All with Hba1c measurements alongside 3-6 monthly
- All stepped up/down dependant on situation
- Periodic testing to meet needs at that time (driving/steroids)
- 1–2 tests daily, varying times of testing (when oral meds changed, new dx)
- 4 tests per day x 2 days a week (routine/settled on meds)
- 4 tests per day each day (insulin/Ramadan)
- 7 tests per day pre and post prandial and before bed (CHO counting, pregnancy)

## Other practical issues to consider:

- Occupational – builders/surgeons/teachers
- Sharps bin access - Each local council may have a different collection service; this should be communicated
- Dexterity – is patient able to use equipment?
- Sensory issues (hearing/sight loss)
- Interpreting and understanding results (dyslexia/unable to read/write)
- Measurements the same? – mmol/L
- Recording SMBG – written diary/bluetooth/apps
- Access to downloadable tech – Diasend (in DSN clinic)

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**Thanks... any questions?**



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