# Self-Monitoring of BG & Continuous Glucose Monitoring

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# Topics of today

1. SMBG – must be a routine care?
2. SMBG steps & common pitfalls
3. Pattern of monitoring
4. POCT – its importance
5. Factors affecting CBG results
6. Choosing a BGA and CGM
7. Hypoglycaemia
8. CBG record sharing

# Self Monitoring of Blood Glucose (SMBG)

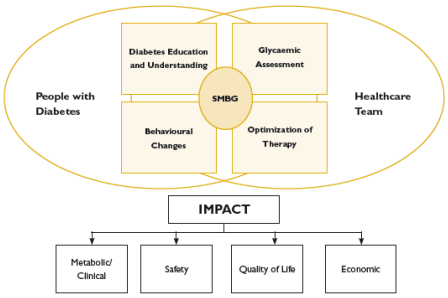
COMMON TERMS:

SMBG
CBG capillary blood glucose
BGA blood glucose analyzer
H'stix (Hemoglucostix)



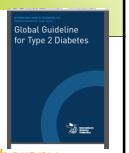


# Role of SMBG in Management of Diabetes




# SMBG on T1DM/ insulin treated T2DM

IDF Guideline for T2DM (2012):




- improvements in diabetic complications from intensive glycaemic control have included SMBG as part of a multifactorial intervention.
- SMBG is thus an integral component of effective therapy for T1DM .
- Studies in insulin treated people with T2DM also suggest that SMBG is required to titrate the insulin dose whilst avoiding hypoglycaemia.
- For T1DM and pregnant women taking insulin, SMBG is recommended 3 or more times daily when intensive glycaemic control is required.




# How about SMBG for non-insulin treated T2DM?



## Observational Study

| Study | Description of purpose | Findings/comments |
|---|---|---|
| Fremantle Diabetes Study[31] | ■ Assessed whether SMBG is an independent predictor of improved outcome in a community-based cohort of T2DM patients<br>■ Used longitudinal data from 1,280 T2DM participants (70% ongoing SMBG users at baseline) and a subset of 531 individuals who attended annual assessments over a 5-year period | ■ SMBG was associated with a 48% decreased risk of cardiovascular mortality in insulin-treated patients, but a 79% increased risk in non-insulin-treated patients<br>■ Time-dependent SMBG was independently associated with a 48% reduced risk of retinopathy in the 5-year cohort<br>*'Inconsistent findings relating to the association of SMBG with cardiac death and retinopathy may be due to confounding, incomplete covariate adjustment or chance'* |
| Kaiser Permanente[28] | ■ Assessed longitudinal association between SMBG and glycaemic control in diabetic patients from an integrated health plan<br>■ Followed 16,091 new SMBG users and 15,347 ongoing users over a 4-year period | ■ Greater SMBG frequency among new users was associated with a graded decrease in $HbA_{1c}$ (relative to non-users) regardless of diabetes therapy<br>■ Longitudinal changes in SMBG frequency were related to significant changes in glycaemic control |
| QuED[29] | ■ Assessed impact of SMBG on metabolic control in non-insulin-treated T2DM subjects (41% ongoing SMBG users at baseline)<br>■ Followed 1,896 patients over a 3-year period | ■ Performance and frequency of SMBG did not predict better metabolic control over 3 years<br>■ Investigators could not identify any specific subgroups for whom SMBG practice was associated with lower $HbA_{1c}$ levels during the study |
| ROSSO[30] | ■ Investigated relationship of SMBG with disease-related morbidity and mortality<br>■ Followed 3,268 patients from diagnosis of T2DM between 1995 and 1999 until end of 2003 (mean follow-up 6.5 years) retrospectively from medical records | ■ SMBG was associated with decreased diabetes-related severe morbidity and all-cause mortality<br>■ This association was also seen in subgroup of non-insulin-treated patients<br>■ Medical records contained data on some biochemical parameters, retinopathy and neuropathy for only a small proportion of patients |

| Study | Description of purpose | Findings/comments |
|---|---|---|
| King-Drew Medical Center Trial[26] | ■ Randomized, single-blind study designed to determine whether SMBG improves HbA1c in non-insulin-treated T2DM patients<br>■ Clinical management decisions were blinded to SMBG data and use<br>■ 89 non-insulin-treated T2DM patients were followed for 6 months | ■ At 6 months, differences in decrease in HbA1c levels were not statistically significant<br>*The rapid upgrading of medication every two weeks if goals were not met may have obscured the potential of SMBG for supporting self-management* |
| ESMON[25] | ■ Prospective randomized controlled trial assessed the effect of SMBG vs no monitoring on glycaemic control and psychological indices in patients with newly diagnosed T2DM<br>■ Evaluated 184 non-insulin-treated patients with no previous use of SMBG over 12 months | ■ There were no significant differences in $HbA_{1c}$ between groups at any time point<br>■ SMBG was associated with a 6% higher score on the depression subscale of the well-being questionnaire<br>*The major improvement of mean $HbA_{1c}$ levels in the control group, from 8.6 to 6.9% indicates a dominant role of medication in disease management* |
| DINAMIC[24] | ■ Multicentre, randomized, parallel-group trial was designed to determine if therapeutic management programmes for T2DM that included SMBG result in greater reductions in $HbA_{1c}$ compared with programmes without SMBG in non-insulin-treated patients<br>■ Followed 610 T2DM patients with early or mild diabetes receiving an identical oral anti-diabetic therapy regimen with gliclazide for 27 weeks | ■ There was a major decrease of $HbA_{1c}$, which was significantly larger in the SMBG group than the control group<br>■ The incidence of symptomatic hypoglycaemia was lower in the SMBG group<br>*The major improvement of $HbA_{1c}$ levels in the control group from 8.1 to 7.2% indicates a dominant role of medication in disease management* |
| German-Austrian[23] | ■ Prospective, multicenter, randomized controlled study Investigated the effect of meal-related SMBG on glycaemic control and well-being in non-insulin-treated T2DM subjects<br>■ Followed 250 non-insulin-treated T2DM patients for 6 months | ■ In per-protocol analysis (n=223) use of SMBG significantly reduced $HbA_{1c}$ levels<br>■ SMBG use resulted in a marked improvement of general well-being with significant improvements in the subitems depression and lack of well-being<br>*The benefit of intense patient care is evident but the contribution of intense vs SMBG cannot be assessed* |
| DiGEM[18] | ■ Three-arm, open, parallel group randomized trial designed to determine whether SMBG alone, or with instruction in incorporating results into self-care, is more effective than standardized usual care in improving glycaemic control in non-insulin-treated T2DM patients<br>■ Followed 453 patients with a mean $HbA_{1c}$ level of 7.5% for a median duration of 1 year | ■ At 12 months the differences in $HbA_{1c}$ level between the three groups were not statistically significant<br>■ Investigators concluded that evidence is not convincing of an effect of SMBG, with or without instruction in incorporating findings into self-care, compared with usual care in reasonably well controlled non-insulin-treated patients with type 2 diabetes. |

## IDF GUIDELINE ON SELF-MONITORING OF BLOOD GLUCOSE IN NON-INSULIN TREATED TYPE 2 DIABETES

www.idf.org/guidelines/self-monitoring

In October 2008, the International Diabetes Federation Clinical Guidelines Task Force, in conjunction with the SMBG International Working Group, convened a workshop in Amsterdam to address the issue of SMBG utilization in people with type 2 diabetes (T2M) that is not treated with insulin. Workshop participants included clinical investigators actively engaged in self-monitoring of blood glucose (SMBG) research and research translation activities. The IDF Guideline on Self-monitoring of Blood Glucose in Non-Insulin Treated Type 2 Diabetes presents a summary of the findings and recommendations of the workshop, related to the use of the SMBG in non-insulin treated people with T2M.

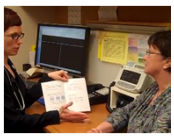



- Download the IDF Guideline on Self-monitoring of Blood Glucose in Non-Insulin Treated Type 2 Diabetes (pdf, 810KB)
- Order the publication from the IDF online shop.

## IDF recommendation

- SMBG use should be based on shared decision making between people with diabetes and their healthcare providers and
- linked to a clear set of instructions on actions to be taken based upon SMBG results.
- SMBG prescription is discouraged in the absence of relevant education and/or ability to modify behaviour or therapy modalities.



*Recommended care*

2009

SM1 Self-monitoring of blood glucose (SMBG) should only be made available to people with diabetes when they have the knowledge, skills and willingness to use the information obtained through testing to actively adjust treatment, enhance understanding of diabetes and assess the effectiveness of the management plan on glycaemic control.

SM2 The purpose(s) of performing SMBG and using SMBG data should be agreed between the person with diabetes and the health-care provider.

SM3 SMBG on an ongoing basis should be available to those people with diabetes using insulin.

SM4 SMBG should be considered for people using oral glucose lowering medications as an optional component of self-management, and in association with $HbA_{1c}$ testing:
- To provide information on, and help avoid, hypoglycaemia.
- To assess changes in blood glucose control due to medications and lifestyle changes.
- To monitor the effects of foods on postprandial glycaemia.
- To monitor changes in blood glucose levels during intercurrent illness.

SM5 Regular use of SMBG should not be considered part of routine care where diabetes is well controlled by nutrition therapy or oral medications alone.

SM6 SMBG protocols (intensity and frequency) should be individualised to address each individual's specific educational/behavioural/clinical requirements, and provider requirements for data on glycaemic patterns to monitor therapeutic decision making.

SM7 Structured assessment of self-monitoring skills, the quality and use made of the results obtained, and of the equipment used, should be made annually.




## IDF recommendation

***Limited care (when limited resources)***

- SMBG using meters with strips, or visually read blood glucose strips, should be considered for people with diabetes using insulin.

**Global *Comprehensive care***

- The principles are as for *Recommended care*, but SMBG could be offered to all people with T2DM irrespective of treatment as part of a comprehensive and ongoing education and therapeutic programme.
- Continuous glucose monitoring (CGM) could be considered in insulin treated people with type 2 diabetes

American Diabetes Association.
Cure • Care • Commitment®

2016
Standard-of Care

*Recommendations*

- When prescribed as part of a broader educational context, self-monitoring of blood glucose (SMBG) results may help to guide treatment decisions and/or self-management for patients using less frequent insulin injections **B** or non-insulin therapies. **E**
- When prescribing SMBG, ensure that patients receive ongoing instruction and regular evaluation of SMBG technique, SMBG results, and their ability to use SMBG data to adjust therapy. **E**
- Most patients on intensive insulin regimens (multiple-dose insulin or insulin pump therapy) should consider SMBG prior to meals and snacks, occasionally postprandially, at bedtime, prior to exercise, when they suspect low blood glucose, after treating low blood glucose until they are normoglycemic, and prior to critical tasks such as driving. **B**
- When used properly, continuous glucose monitoring (CGM) in conjunction with intensive insulin regimens is a useful tool to lower A1C in selected adults (aged ≥25 years) with type 1 diabetes. **A**
- Although the evidence for A1C lowering is less strong in children, teens, and younger adults, CGM may be helpful in these groups. Success correlates with adherence to ongoing use of the device. **B**
- CGM may be a supplemental tool to SMBG in those with hypoglycemia unawareness and/or frequent hypoglycemic episodes. **C**
- Given variable adherence to CGM, assess individual readiness for continuing CGM use prior to prescribing. **E**
- When prescribing CGM, robust diabetes education, training, and support are required for optimal CGM implementation and ongoing use. **E**
- People who have been successfully using CGM should have continued access after they turn 65 years of age. **E**

## 1. SMBG – must be a routine care for diabetes?

Yes→ for T1DM/ T2DM on insulin/ T2DM on oral glucose lowering agents

No /May Be → for T2DM on MNT/ oral medicine in well control

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## SMBG 自我測試血糖

To follow the BG analyzer instructions
必須依照個別血糖機的指引及步驟說明進行血糖測試。



Steps 一般驗血糖步驟：

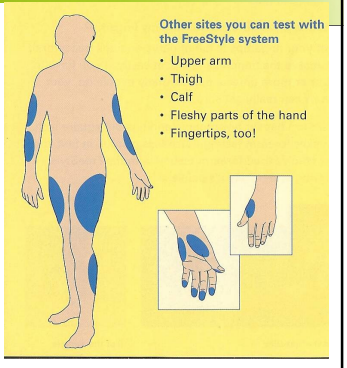
❶ wash hands and dry 洗手及抹乾 / +/-用火酒片清潔指頭
❷ Dry finger before pricking 等待皮膚全乾才可作穿刺
❸ To prick the sides of finder tip可在手指兩側作穿刺
❹ Collect blood sample genteelly 輕力擠出血液（不可過分擠壓）
❺ Blood testing 驗血



❻ Aftercare 善後工作（利器處理、用紙巾包好驗血紙等棄掉）
❼ Keep CBG record and analysis 記錄驗血結果及作細心分析

## Alternative site for testing

- Special pricking device
- Less painful
- Blood flow to finger is 3-5 times faster than to the arm
- Fingertip blood may show these changes sooner than other areas.
- Alternative site is not recommended for post-prandial / hypoG testing.




## Common Pitfall on SMBG
## Would you identify the Problems ?



## Would you identify the Problems ?




## When obtaining a blood sampling



X If the blood smears or runs, do not use as alcohol / sweat on the skin may cause underestimation of the blood glucose result.



✓Get a round drop of blood

20

## COMMON PITFALLS on SMBG

1. Meter maintenance:
   Coding (calibration) / BG units / no annual POCT
2. Strip Storage:
   Expired strips / Improper storage/ uncapped bottle/ Temperature
3. Skill related:
   Wet finger / alcohol swab/ drop size/ over squeeze blood sample
4. Operator's related:
   Improper technique in using meter (BGA upside down / direct lancet)
   Poor charting & record keeping

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## 血糖記錄表

| 日期 | 空肚 | 早餐後 | 午餐前 | 午餐後 | 晚餐前 | 晚餐後 | 備註 |
|---|---|---|---|---|---|---|---|
| 1-8 | 6.4 | | 13.2 | | 12.3 | 14.3 | AM 未吃藥 |
| 10-8 | 9.5 | | 11.0 | 搬貨 | 3.5 | 5.8 | 4am 3.2 |
| 18-8 | 11.4 | | 3.0 | 19.2 | 17.0 | 15.1 | 遲食午餐 |
| 19-8 | 11.2 | | | | | | |

每星期1-2天，1天 3-4次

## Low Intensity

**Figure 3. Examples of low-intensity SMBG regimens**

*Meal-based testing*

| | Pre-Breakfast | Post-Breakfast | Pre-Lunch | Post-Lunch | Pre-Supper | Post-Supper | Bedtime |
|---|---|---|---|---|---|---|---|
| Monday | x | x | | | | | |
| Tuesday | | | | | | | |
| Wednesday | | | x | x | | | |
| Thursday | | | | | | | |
| Friday | | | | | | | |
| Saturday | | | | | x | x | |
| Sunday | | | | | | | |

## Moderate Intensity

*'Staggered' SMBG regimen*

| | Pre-Breakfast | Post-Breakfast | Pre-Lunch | Post-Lunch | Pre-Supper | Post-Supper | Bedtime |
|---|---|---|---|---|---|---|---|
| Monday | X | X | | | | | |
| Tuesday | | | X | X | | | |
| Wednesday | | | | | X | X | |
| Thursday | X | X | | | | | |
| Friday | | | X | X | | | |
| Saturday | | | | | X | X | |
| Sunday | X | X | | | | | |

## Intensive Monitoring

**Figure 2. Examples of focused SMBG regimens**

*5-point profile*

| | Pre-Breakfast | Post-Breakfast | Pre-Lunch | Post-Lunch | Pre-Supper | Post-Supper | Bedtime |
|---|---|---|---|---|---|---|---|
| Monday | | | | | | | |
| Tuesday | | | | | | | |
| Wednesday | X | X | | X | X | X | |
| Thursday | X | X | | X | X | X | |
| Friday | X | X | | X | X | X | |
| Saturday | | | | | | | |
| Sunday | | | | | | | |

## 自我監測血糖建議方案

Diabetes Hong Kong Position Statement 2008




## Frequency of SMBG 做幾多次？ No standard guideline

| 早餐前 | 早餐後 | 午餐前 | 午餐後 2 小時 | 晚餐前 | 晚餐後 2 小時 | 睡前 | 備註 |
|---|---|---|---|---|---|---|---|
| ✓ | | | | ✓ | ✓ | for taking OAD with fair control | |
| ✓ | | ✓ | | ✓ | | ✓ for taking insulin with fair control | |
| ✓ | ✓ | | ✓ | | ✓ for GDM women. Pt need tight control. Pt optimized pre-meal CBG, then target at post-meal CBGs. | | |
| ✓ | ✓ | | | | | | Check in pairs, to observe post-meal excursion. Also assess meal effects |
| | | ✓ | ✓ | | | | |
| | | | | ✓ | ✓ | | |

## 理想血糖範圍 Ideal Blood Sugar Level

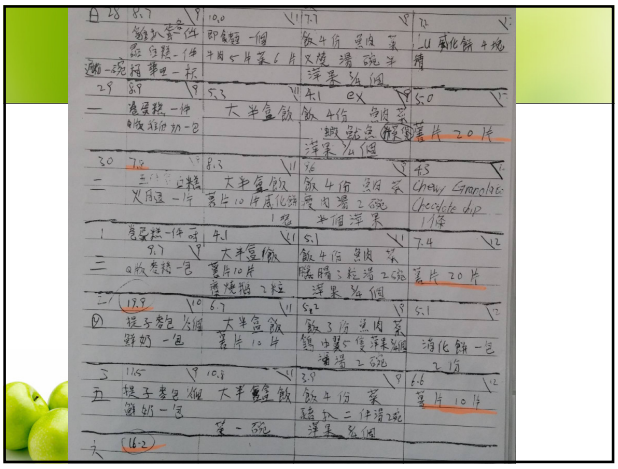
空腹 / 餐前 Fasting / Pre-meal — 4-7 mmol/L

餐後2小時 2hrs after meal — 4-8 mmol/L（低於10）



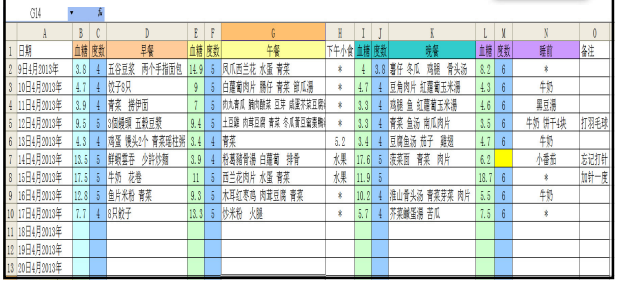
## BG record book





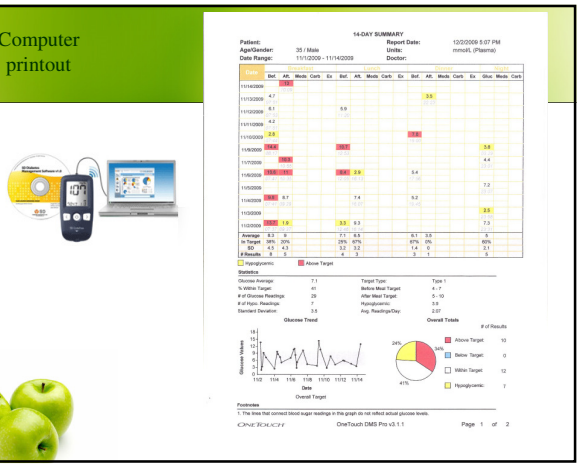
## 記錄在案 -- 電腦Excel檔案

- 血糖值
- 注射度數
- 食物內容、CHO量
- 備註欄
- 活動量



| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 日期 | 血糖 | 度數 | 早餐 | 血糖 | 度數 | 午餐 | 下午小食 | 血糖 | 度數 | 晚餐 | 血糖 | 度數 | 睡前 | 備注 |
| 2 | 9日4月2013年 | 3.8 | 4 | 五谷豆浆 两个手指面包 | 14.9 | 5 | 风爪西兰花 水果 青菜 | * | 4 | 3.8 | 薯仔 冬瓜 鸡腿 青头汤 | 8.2 | 6 | * | |
| 3 | 10日4月2013年 | 4.7 | 4 | 饮子8只 | 9 | 5 | 白灌蜜肉片 腰仔 青菜 胡瓜汤 | * | 4.7 | 4 | 豆角肉片 红腰蜜玉米汤 | 4.3 | 6 | 牛奶 | |
| 4 | 11日4月2013年 | 3.9 | 4 | 青菜 排仲面 | 7 | 5 | 肉丸意仁 鹅咀鹅菜 豆芽 咸蛋苦瓜豚 | * | 3.3 | 4 | 鸡腿 鱼 红腰蜜玉米汤 | 4.6 | 6 | 黑豆浆 | |
| 5 | 12日4月2013年 | 9.5 | 5 | 3面腰腸 五粮豆浆 | 9.4 | 5 | 土豆粉 肉丝豆腐 青菜 冬瓜蜜豆腐蜜腸 | * | 3.3 | 4 | 青菜 鱼汤 南瓜肉片 | 3.3 | 6 | 牛奶 饼干1块 | 打羽毛球 |
| 6 | 13日4月2013年 | 4.3 | 4 | 鸡蛋 腰头2个 青菜瘦猪肉 | 3.4 | 4 | 青菜 | 5.2 | 3.4 | 4 | 豆腐鱼汤 筋子 腰腿 | 4.7 | 6 | 牛奶 | |
| 7 | 14日4月2013年 | 13.5 | 5 | 鲜蘑意苦 少许炒麵 | 3.9 | 4 | 粉葛腩骨汤 白灌蜜 排骨 | 水果 | 17.6 | 5 | 菠菜面 青菜 肉片 | 6.2 | | 小番茄 | 忘记打针 |
| 8 | 15日4月2013年 | 17.5 | 5 | 牛奶 花卷 | 11 | 5 | 西兰花肉片 水果 青菜 | 水果 | 11.9 | 5 | | 18.7 | 6 | * | 加针一度 |
| 9 | 16日4月2013年 | 12.8 | 5 | 鱼片米粉 青菜 | 9.3 | 5 | 木耳红枣鸡 肉蛋豆腐 青菜 | * | 10.2 | 4 | 指山青头汤 青菜芽菜 肉片 | 5.5 | 6 | 牛奶 | |
| 10 | 17日4月2013年 | 7.7 | 4 | 8只蚊子 | 13.3 | 5 | 炒米粉 火腿 | * | 5.7 | 4 | 芥菜鲫鱼汤 苦瓜 | 7.5 | 6 | * | |
| 11 | 18日4月2013年 | | | | | | | | | | | | | | |
| 12 | 19日4月2013年 | | | | | | | | | | | | | | |
| 13 | 20日4月2013年 | | | | | | | | | | | | | | |

Computer printout





## 手機Apps程式

OnTrack Diabetes
GExperts Inc



Like

全面血糖 /食物 / 注射分量記錄

- 詳細圖表分析總覽
- 24小時血糖高低分佈
- 有Logbook view






Dislike

- 血糖 /食物 / 注射分量記錄分析分開3頁
- 英文系統
- Setting頗複雜

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# POCT
# Point-of Care Testing

## QC on BGA and BG strips

## What is POCT?

- Laboratory test performed outside Pathology Laboratories
- Performed by non-laboratory professionals

**Classification of Complexity of Testing for POCT/ Devices***

| Complexity of Testing* | Level I | Level II |
|---|---|---|
| Description | Low complexity of testing | Moderate to high complexity of testing |
| Type of POCT/ Devices | 1. Glucometers, e.g. Bayer Contour® TS system, Roche Accu-Chek® Performa system.<br>2. Haemoglobinometers, e.g. HemoCue® Haemoglobin system.<br>3. Copper sulphate screening test for haemoglobin (blood donor) | All types of POCT/ devices NOT classified as Level I. |
| POCT Operator Requirement | Well-trained hospital staff, including ancillary staff. | Well-trained professional staff (doctors, nurses, medical technologists, other specialists). |

* Urine dipstick tests which are simple to perform with little potential for adverse medical consequence are exempted from compliancy to this Policy. However it should be noted that performance of these tests should adhere to the manufacturer's instructions. Exempted tests include urine test strips for glucose, protein, ketone, red blood cells, pH, bilirubin and urobilinogen.

* Factors considered include complexity of testing methodology, potential analytical interference, clinical importance, medical-legal implications, availability of positive patient identification, etc.

HA POCT Policy v2.1 Nov 2010

**Patient factors**

? In shock ? haematocruit levels ? received drugs affecting the accuracy of BGAs...

**Operator factors**

knowledge and skill on using BGAs & results interpretation, wrong results entry...

An accurate capillary blood glucose result.....

**Instrument / Reagent factors**

- Mac
blood
strip



**Environmental factors**

light, humidity, temperature.....

Clinical use BGA: check QC within 24 hrs before use

Patient Home use: annual checking




## POCT BGA Quality Assurance Prog.

| Internal QC test | External QC test |
|---|---|
| -Control solutions are supplied by manufacturers<br>- normal reference range are available in the insert or packing box | -Control solutions are supplied by PWH Department of Chemical Pathology monthly<br>-Reference range are worked out from the submitted QC results based on 95% confidence interval |
|  |  |

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## 5. Factors affecting CBG results

## Limitations in CBG measurements

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## IDF guideline mentioned…

"The IFCC* have proposed that plasma rather than blood glucose values should be reported by blood glucose meters (blood glucose x 1.1 = plasma glucose)."

e.g. whole BG 10mmol/l = plasma glucose 11mmol/l

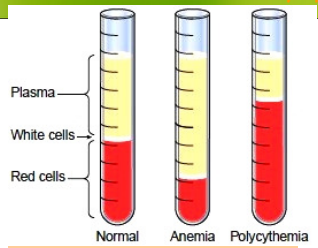
*International Federation of Clinical Chemistry and Laboratory Medicine

## Limitations in CBG measurements – patient issue

- ✓ **Some hospitals POCT Committee** recommended to send a glucose sample to the laboratory for confirmation if the POC (BGA) glucose is <3.0 or >20 mmol/L.
- ✓ Capillary blood glucose testing not clinically appropriate for persons with reduced peripheral blood flow, shock, severe hypotension, hyperosmolar hyperglycaemia and severe dehydration.
- ✓ if < 80mmHg, blood leaves finger tip & move to central part of body → in hypotensive state, fingerprick glucose is less than venous or arterial specimens
- ✓ CBG results should not be a diagnostic value to define DIABETES.

44

## ** Haematocrit (Hct) 紅血球容積 Anaemia or Polycythemia




- acute illness – lower Hct at ~ 30%
- Neonates – higher Hct at 60 - 70%
- Diabetic ketoacidosis – hihger Hct at ~ 60%

| Hct = | M 40-50% F 35-44% | ↓ | ↑ |
|---|---|---|---|
| BG value tested to have: | Accurate BG value tested | Falsely high BG value | Falsely low BG value |

*BGA with larger Hct range is preferred.*

*"PXP/ Optium" for Hct: 20-70%*

*"Contour TS" fit for Hct : 0-70%*

## Limitations in CBG measurements – Patient's haematocruit (Hct) issues

- ✓ For neonates, they have higher Hct in general (~60 - 70%)
- ✓ For patients having anaemia, they have lower Hct
- ✓ patients with diabetic ketoacidosis, they have higher Hct in general

  If the Hct level of a patient is too extreme which beyond the Hct claims from the POCT BGA devices, the accuracy of BGA readings may tend to be inaccurate:
- ✓ Too high Hct level may give rise to falsely low blood glucose readings;
- ✓ Too low Hct level may give rise to falsely high blood glucose readings.

## Topics of today

1. SMBG – must be a routine care?
2. SMBG steps & common pitfalls
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4. POCT – its importance
5. Factors affecting CBG results
6. Choosing a BGA and CGM
7. Hypoglycaemia
8. CBG record sharing



## IF you were the client, please choose one BGA you like most and WHY?



- Type 1 boy, 8-yr-old
- Businessman, frequent traveler
- Housewife, 55-yr-old
- Elderly, poor vision, 80-yr-old
- SMBG done by domestic helper, career




## Guidelines on introduction of blood glucose analyzer to diabetic patients and their significant others

by Diabetes Educators Group 2002
Daibetes Division, HKSEMR



## Guidelines on introduction of BGA --1

1. Patients and their significant others should be informed of their freedom in choosing the brand and model of blood glucose analyzer (BGA).
2. Diabetes educator should assist patients and their significant others in choosing an appropriate BGA by providing relevant information after assessment.
3. Diabetes educator should introduce more than one BGA.

## Guidelines on introduction of BGA --2

4. Pre-teaching assessment of patient / significant others includes:
   - Age
   - Visual ability
   - Learning ability
   - Financial situation
   - Patient preference
   - Risk of lancet stick injury for significant others when using the lancet device for the procedure



## Objective data on BGA should be considered to compare among different models:

| Specificity | Assessment Criteria |
|---|---|
| **Accuracy & Safety** | Approved by FDA or CE international safety and accuracy standard |
| **Easy of Use** | Simplicity of the operation and calibration, size, clarity of screen display and error message, testing time, blood volume requirement, internal quality control, convenience of maintenance of the BGA |
| **Cost** | Price of BGA, test strips, lancets and automatic lancing devices, and batteries. |
| **Additional function** | Requirement for accessory function (e.g. testing blood cholesterol, triglycerides or ketones), and connection to data-management systems. |
| **Available of maintenance & supporting service** | Availability of local maintenance and supporting service, ease of purchasing accessories. |

## Non-invasive BGA Combo Glucometer






# Continuous Glucose Monitoring (CGM)





# Continuous Glucose Monitoring (CGM)

ADA 2014 Guidelines



| | |
|---|---|
| Useful for A1C lowering in select adults (≥25 yrs) with type 1 diabetes requiring intensive insulin | • May be useful among children, teens, younger adults*<br>• Success related to adherence, ongoing use |
| May be a useful supplement to SMBG among patients with… | • Hypoglycemia unawareness and/or<br>• Frequent hypoglycemic episodes |

*Evidence for A1C lowering less strong in these populations
SMBG=self-monitoring of blood glucose

American Diabetes Association. *Diabetes Care*. 2014;37(suppl 1):S14-S80.

# CGM service in HK



- Metronic: i-Pro (7 days)
  Tel: 29191322



- Celki: Dexcom (7 days)
  Tel: 23323366

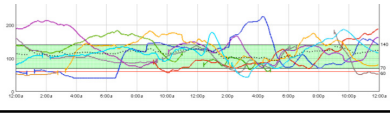
- Abbott: Ambulatory Glucose Profile (AGP) by Libre
  Coming soon





# Indication for CGM (one-off)

- To obtain a dynamic and complete glucose information for titration of treatment regimen
- Fluctuation of SMBG profile
- Unexplained frequent hyper/hypoglycaemia
- Detect any nocturnal hypoglycaemia/ hypo-unawareness
- Discrepancy of A1c & SMBG reading
- Understand BG change associated with diet/ exercise / lifestyle issues
- Pre/post-insulin pump therapy assessment



# Case study:

M/62, chef

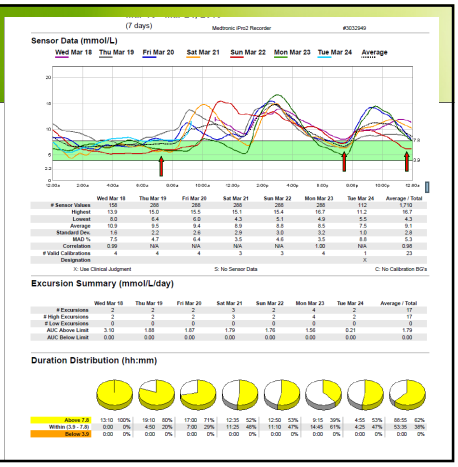
T2DM

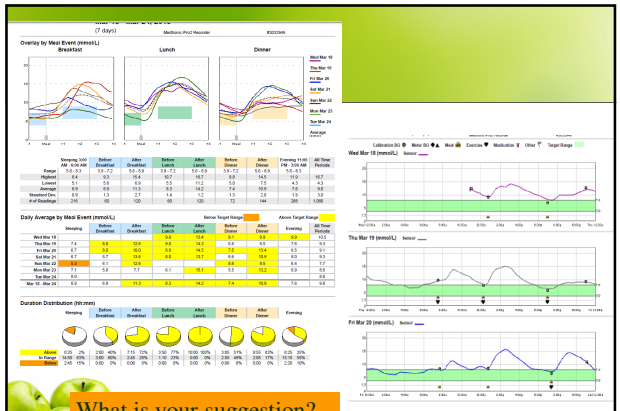
On MDI:

Actrapid
20units pre-B
18 units pre-L
24 units pre-D

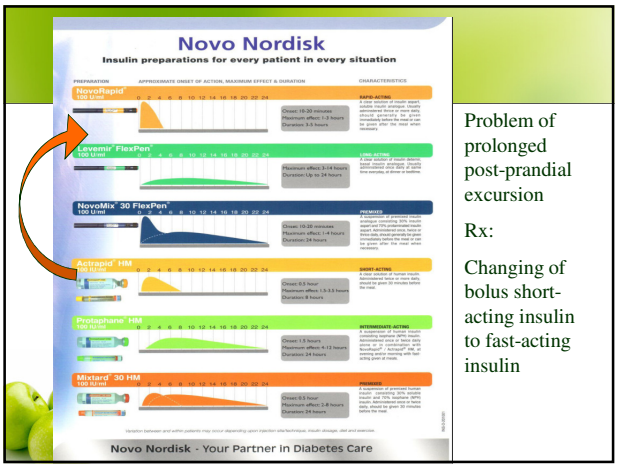
Protaphane 36 units nocte

HbA1c 9.4%



What is your suggestion?




Problem of prolonged post-prandial excursion

Rx:

Changing of bolus short-acting insulin to fast-acting insulin




# Topics of today

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7. Hypoglycaemia
8. CBG record sharing

低血糖

<4.0

## Signs and Symptoms of Hypoglycaemia

**EARLY signs & symptoms**

Autonomic (Adrenergic)

- Hunger
- Shaking, tremor
- Sweating
- Palpitations
- Anxious
- Nausea
- Pallor
- Hunger



**Late signs of hypoglycaemia**

Neuroglycopenic

- Dizziness
- Irritability
- loss of concentration
- Confusion
- Slurred Speech
- Incoordination
- Hemiparesis
- Seizures
- Coma



## Causes of Hypoglycaemia

- Insulin/oral anti-diabetic drug overdose
- Delayed or missed meal
- Drinking too much alcohol / drinking without food
- Deterioration of renal and hepatic function
- Not adequate carbohydrates
- Unplanned/vigorous exercise
- Drug interactions
- Other factors



## Potential causes of In-patient hypoglycaemia

Imbalanced meal issues

- Missed or delayed meal
- Taken less carbohydrate than needed
- Vomiting
- Reduced appetite
- Prolonged NPO (Nil by mouth)
- Changed meal times and scheduled



Medical issues

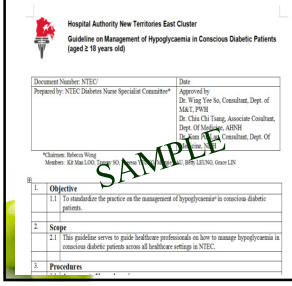
- Inappropriate use of "Stat" or "PRN" dose short-acting insulin
- Recovery from acute illness/infection
- Increased mobility
- Changed insulin regime
- Discontinuation of long-term steroid therapy
- Incorrect insulin prescribed and administered
- IV insulin infusion without glucose infusion
- Major amputation of a limb



## Treatment of hypoglycaemia

In-hospital setting

- Follow the hospital guidelines


Hospital Authority New Territories East Cluster

Guideline on Management of Hypoglycaemia in Conscious Diabetic Patients (aged ≥ 18 years old)

| Document Number: NTEC/ | Date: |
|---|---|
| Prepared by: NTEC Diabetes Nurse Specialist Committee* | Approved by: Dr. Wing Yee So, Consultant, Dept. of M&T, PWH; Dr. Chin Chi Tsang, Associate Consultant, Dept. Of Medicine, ARHH; Dr. Kam Wa Lo, Consultant, Dept. Of |

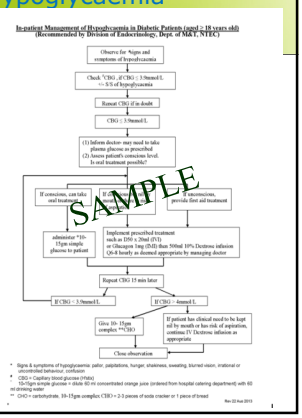
*Chairman: Rebecca Wong
Members: Kit Man LOO, Grace LIN

1. Objective
1.1 To standardize the practice on the management of hypoglycaemia* in conscious diabetic patients.

2. Scope
2.1 This guideline serves to guide healthcare professionals on how to manage hypoglycaemia in conscious diabetic patients across all healthcare settings in NTEC.

3. Procedures

SAMPLE


In-patient Management of Hypoglycaemia in Diabetic Patients (aged ≥ 18 years old) (Recommended by Division of Endocrinology, Dept. of M&T, NTEC)

Observe for *signs and symptoms of hypoglycaemia

Check **CBG, if CBG < 3.9mmol/L +/- S/S of hypoglycaemia

Repeat CBG if in doubt

CBG < 3.9mmol/L

(1) Inform doctor- may need to take plasma glucose as prescribed
(2) Assess patient's conscious level.
Is oral treatment possible?

If conscious, can take oral treatment

If unconscious, provide first aid treatment

administer *10-15gm simple glucose to patient

Implement prescribed treatment such as D50 ± 20ml (IV); or Glucagon 1mg (IM) then 500ml 10% Dextrose infusion or D5-8 hourly as deemed appropriate by managing doctor

Repeat CBG 15 min later

If CBG < 3.9mmol/L

If CBG > 4mmol/L

Give 10- 15gm complex **CHO

If patient has clinical need to be kept nil by mouth or has risk of aspiration, continue IV Dextrose infusion as appropriate

Close observation

* Signs & symptoms of hypoglycaemia: pallor, palpitations, hunger, shakiness, sweating, blurred vision, irrational or uncontrolled behaviour, confusion
** CBG = Capillary blood glucose (Finger prick)
10-15gm simple glucose = dilute 60 ml concentrated orange juice (ordered from hospital catering department) with 60 ml drinking water
*** CHO = carbohydrate. 10-15gm complex CHO = 2-3 pieces of soda cracker or 1 piece of bread

SAMPLE

## Treatment of hypoglycaemia

15/15 rule

1. Take 10-15g simple CHO
2. Wait for 15 mins.
   If no improvement, take 10-15g simple CHO again
3. If feel better, take 10-15g complex CHO







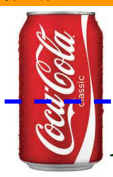



## 10-15g 單糖甜糖 /飲品 Simple Sugar

先
Simple sugar



糖果 (小) 3-4
糖果 (大) 2




150 cc

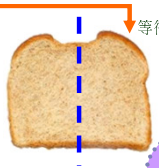




等待15分鐘
minutes



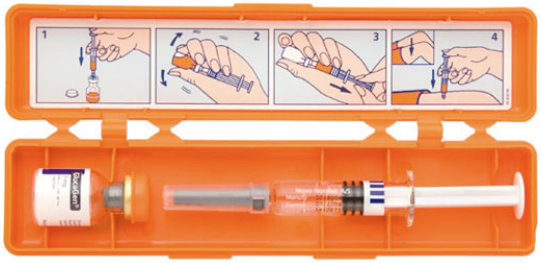




後
Starchy foods

10-15g醣質食物 Complex Carbohydrate

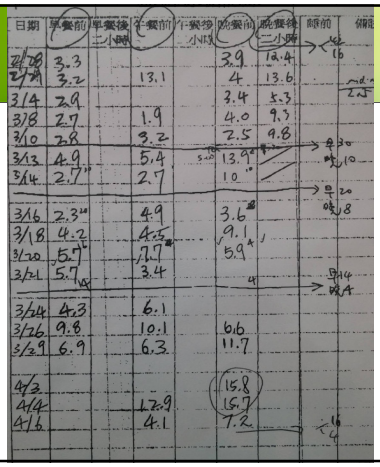
## Glucagon injection 1mg




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## Case 1:



## Case 2:

M/65, Leg abscess, admitted for I&D

on Humulin N 12 units om, 6 units pm since d/c

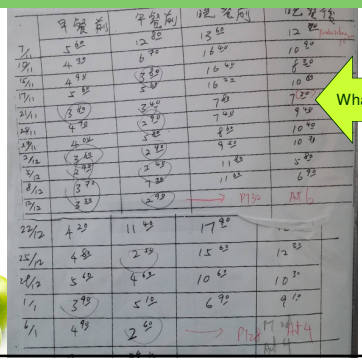
c/o nocturnal hypoG

What would you suggest?




Case 3: F /66, T2DM, Resp BOOT on steroid (Prednisolone 10mg om)
Protaphane 34 units om, Actrapid 8 unite pre-L

What happened??



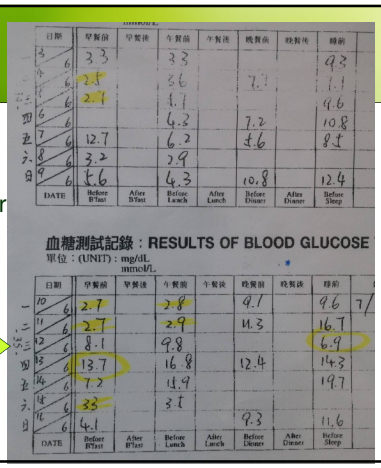
## Case 4:

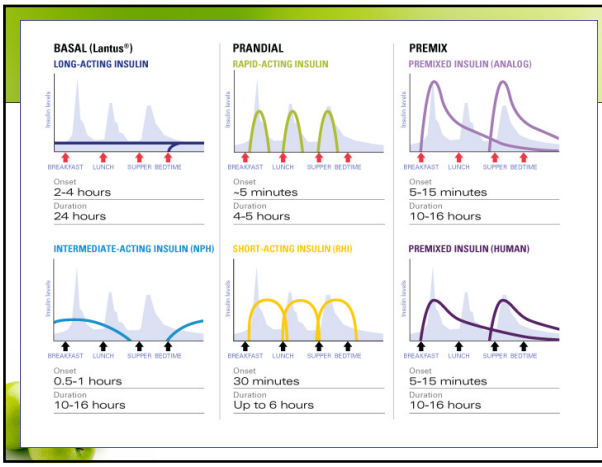
F6 girl, Type 1 on

Humalog7/10/10, PT 25 nocte

Noted hypo+ after exam

What would you suggest?




## Useful Link

1. International Diabetes federation
http://www.idf.org

2. American Diabetes Association
http://www.diabetes.org/

3. Canadian Diabetes Asso.
http://www.diabetes.ca/

4. British Diabetes Asso.
http://www.diabetes.org.uk/

5. Tai Wan Diabetes Asso.
http://homepage.vghtpe.gov.tw/~meta/hospital/index.htm

1. DHK
http://www.diabetes-hk.org/home.asp

2. HKFRDD
http://hkfrdd.org/chinese/d04b.htm

3. Yao Chung Kit Diabetes Assessment Centre, CUHK
http://yckdac.hkido.cuhk.edu.hk

4. 亞洲糖尿病基金會
http://www.adf.org.hk/

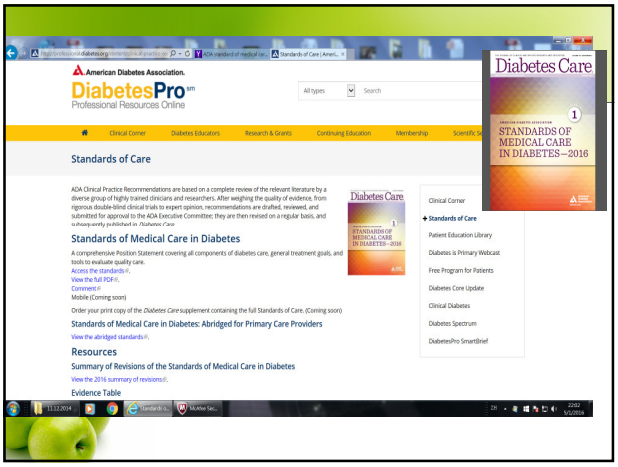
5. 護理小百科 – 糖尿病人士健康生活網站
http://www.cuhk.edu.hk/med/nur/caring/dm.html

6. 醫院管理局健康資訊天地
http://www13.ha.org.hk/healthinfoworld/intro1.aspx

7. 香港醫院管理局 – 智友站
http://www21.ha.org.hk/smartpatient/tc/home.html

8. 香港醫院管理局 – 營養資訊中心
http://www.ha.org.hk/dic

9. 基督教聯合那打素社康服務
http://www.ucn.org.hk




# Reference


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- ADA web site: http://www.diabetes.org/
- Diabetes Hong Kong : http://diabetes-hk.org
- IDF : http://www.idf.org/
- IDF, 2012. Global Guideline for Type 2 Diabetes
- IDF, 2009. Self-Monitoring of Blood Glucose in Non-Insulin-Treated Type 2 Diabetes
- IDF Centre of Education - Hong Kong website: www.idfce-hk.org
- Sheri, et al. (2010) Exercise and Type 2 Diabetes: The American College of Sports Medicine and the American Diabetes Association: join position statement. Diabetes Care, Dec 33: e147-e167