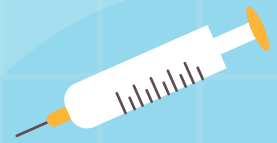
香港兒童醫院
Hong Kong Children's Hospital

Youth Diabetes Action
兒童糖尿協會



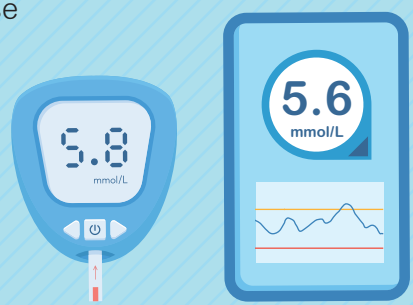
連續葡萄糖監測裝置
Continuous Glucose Monitoring System

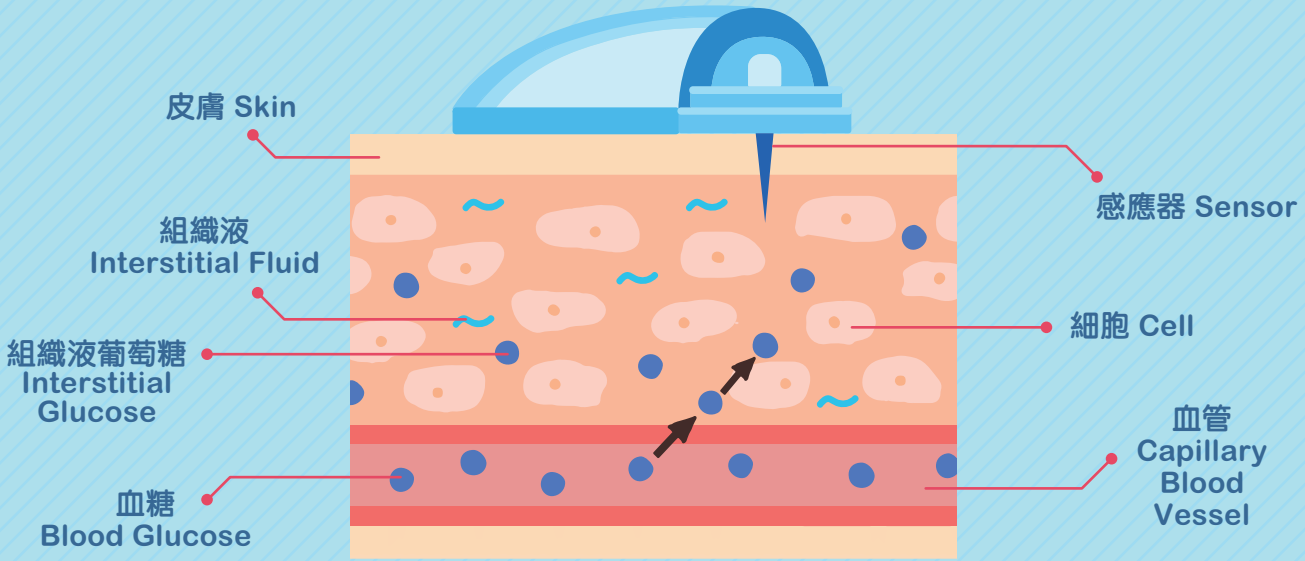
新手入門
A Guide for Beginners

目錄 Content

甚麼是連續葡萄糖監測裝置（CGMS）？
What is Continuous Glucose Monitoring System (CGMS)?

- CGMS是植入在皮膚下的感應器，可持續監測組織液的葡萄糖濃度
  CGMS is a device inserted under the skin to measure interstitial glucose level continuously
- 感應器讀數是來自組織液而非血液，因此可能與血糖讀數不同
  Sensor readings may be different from blood glucose readings because it measures glucose concentration in interstitial fluid
- 組織液葡萄糖相對血糖變化大約延遲5-10分鐘
  There is a lag time of 5-10 minutes between CGMS and blood glucose
- 與傳統血糖機不同，CGMS除了提供當刻的葡萄糖數據外，還可以提供之前的葡萄糖數據及變化
  Unlike traditional blood glucose meters, CGMS gives additional information on your glucose trends based on your previous glucose level
- 部份型號還會發出葡萄糖水平過高或過低的警報
  Some models also have alarms to alert you to high or low glucose levels





CGMS有哪些組成部分？
What are the components of CGMS?

CGMS由三個部分組成 — 感應器、發射器和接收器
CGMS consists of three components - sensor, transmitter and receiver

感應器 Sensor

- 透過植入皮膚下方的幼軟管測量組織液葡萄糖水平
  Contains a small filament that sits beneath the skin and measures interstitial fluid glucose levels
- 裝上後，因應不同型號會有不同的起動時間。在起動期內如要做出治療決定，應先篤手指測血糖
  After placement, there is a period of warm-up time which varies with each model. During warm-up time, finger-prick tests should be used for treatment decisions
- 視乎不同型號，感應器可以使用7-14天
  Depending on the model, the sensor can be worn for 7-14 days

發射器 Transmitter

- 獨立或內置於感應器
  Either separate or built-in with the sensor
- 與感應器直接連接，並自動或在你掃描感應器時將葡萄糖讀數無線發送到接收器/智能手機
  Directly contacts the sensor and sends glucose information wirelessly to the receiver/smartphone, either automatically or when you scan the sensor

接收器/智能手機 Receiver/smartphone

- 接收從發射器而來的葡萄糖讀數
  Receives glucose information from the transmitter
- 視乎CGMS型號，可以是手機般大小的設備，或是智能手機上的應用程式
  Depending on CGMS model, it can either be a small device about the size of a mobile phone or an app on your smartphone

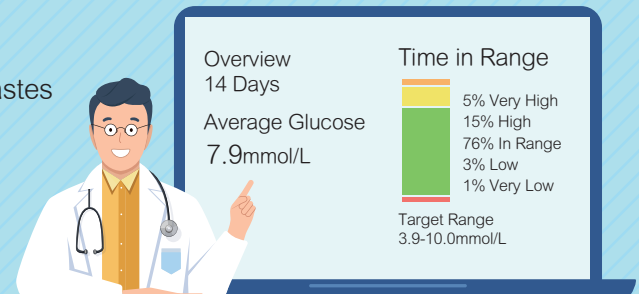
使用CGMS有甚麼優點和缺點？
What are the advantages and disadvantages of using CGMS?

優點 Advantages

- 檢查血糖水平是管理糖尿病的重要部分，所以要定時篤手指。而CGMS每天採集數百個葡萄糖讀數，可減少篤手指次數
  Checking blood glucose levels is a crucial part in diabetes management which requires routine finger-prick. CGMS captures hundreds of sensor glucose readings a day and lessens the number of finger-prick blood glucose monitoring that has to be done
- 因應胰島素劑量、食物、運動、疾病等顯示葡萄糖水平的改變
  It provides information on how your glucose levels fluctuate with insulin doses, diet, exercise, sickness, etc.
- 警報功能和趨勢箭咀有助於調整胰島素劑量及預防低血糖
  Alarm function and trend arrows help with better adjustment of insulin dosages and prevent low blood glucose
- 可以與照顧者/父母及醫療團隊共享葡萄糖數據
  Glucose data can be shared with caretakers/parents and the medical team
- 葡萄糖控制指標，包括達標時率、葡萄糖升降度和趨勢圖，有助於醫療團隊作出更準確的治療方案
  Glucose metrics including time-in-range, glucose variability and trend graphs help medical team to make management decision more accurately
- 研究顯示使用CGMS有助改善糖尿病患者的葡萄糖控制及減少發生低血糖
  Research studies have demonstrated that use of CGMS helps to improve glucose control and reduce events of low blood glucose in people with diabetes

缺點 Disadvantages

- 警報疲勞和信息超載
  Alarm fatigue and information overload
- 皮膚過敏
  Skin irritation
- 裝置需植入皮膚
  Having a device attached to the body
- 價錢
  Cost
- 醫療廢物
  Medical wastes



誰應該使用CGMS？
Who should use a CGMS?

一型或二型糖尿病患者佩戴CGMS都有益處

People with either Type 1 or Type 2 diabetes may benefit from wearing CGMS

但你應 …
But you should be...

- 願意大部分時間佩戴感應器
  Willing to wear a sensor most of the time
- 要有回應CGMS警報的準備，在需要時篤手指及定期更換感應器
  Ready to respond to CGMS alarms, do finger-prick tests when needed and replace the sensor regularly

我還需要篤手指嗎？
Do I still need to do finger-prick tests?

在這些情況下仍需要篤手指的
Finger-prick tests are still necessary in these occasions

- 部份型號需要定時靠篤手指去校準，以保持讀數準確
  Some models need to be calibrated by finger-prick regularly to maintain accurate readings
- 當你的感應器讀數過低（< 4mmol/L）或過高（>15mmol/L）時，尤其是當你需要補針時
  When your sensor glucose readings are low (< 4mmol/L) or high (> 15mmol/L), especially when you need to give a correction dose of insulin
- 當你有低血糖或高血糖症狀時
  When you have symptoms of low or high blood glucose
- 當感應器讀數“不正常”或不能檢測讀數時，例如當你的感應器處於起動期
  When your sensor glucose reading appears to be ‘unusual’ or not available, for example when your sensor is warming up

目前香港有哪些不同的CGMS？
What are the different CGMS currently available in Hong Kong?

型號 Model	Abbott FreeStyle Libre	Abbott FreeStyle Libre 3**	Dexcom G6	Dexcom G7	Medtronic Guardian Sensor 3	Medtronic Guardian 4 Sensor
模式 Mode	需用接收器 / 智能手機掃瞄讀取 Intermittently scanned CGMS (available only when sensor is scanned)	實時傳送 Real-time CGMS				
校準 Calibration	不需要 None				要，每天2次 Yes, twice per day	不需要 None
使用日數 Sensor wear	14天 14 days		10天 10 days		7天 7 days	
發射器 Transmitter	不適用 N.A.	即棄 Disposable	3個月 3 months	即棄 Disposable	1年 1 year	
起動時間 Warm-up period	1小時 1 hour		2小時 2 hours	30分鐘 30 minutes	2小時 2 hours	
最低使用年齡 Approved age	4歲或以上 Age 4 or up		2歲或以上 Age 2 or up		7歲或以上 Age 7 or up	
建議部位（歲） Recommended sites (Age)	手臂/Arm		手臂 / Arm 腹部 / Abdomen 臀部 / Buttock (2-17)	手臂 / Arm 腹部 / Abdomen 臀部 / Buttock (2-6)	手臂 / Arm 腹部 / Abdomen	手臂 / Arm 腹部 / Abdomen (18+) 臀部 / Buttock (7-17)
分享讀數 Data sharing	可以 Yes					
接收器 Receiver	接收器 / 智能手機 Reader / Smartphone				智能手機 / 胰島素泵 Smartphone / Insulin pump	
監測葡萄糖頻率 Frequency of glucose measurement	每分鐘 （以前15分鐘估算） Every minute (a calculated value of previous 15 minutes)	每分鐘 Every minute	每5分鐘 Every 5 minutes			
數據中斷 Data loss	超過8小時沒有掃瞄 Without scanning more than 8 hours	接收器 / 智能手機距離發射器多於6米 When transmitter and receiver/ smartphone are > 6 meters apart				
預測低血糖警報 Predictive low glucose alert	沒有 No	有 Yes				
軟件 Software	LibreView		Dexcom Clarity		Carelink	
藥物影響 Drug Interference	Vitamin C, aspirin 維他命C，阿士匹靈		Hydroxyurea, Acetaminophen 羥基脲，撲熱息痛	Hydroxyurea 羥基脲	Hydroxyurea 羥基脲	

** 預計快將在香港推出 Expected to be launched in Hong Kong soon

實時CGMS信息 — 趨勢箭咀
Real-time CGMS information – trend arrows

- 可顯示葡萄糖水平的變化
  Indicate rate of change of glucose levels
- 可顯示葡萄糖水平上升或下降的速度
  Tell you how rapid glucose levels are rising or falling
- 可讓你能在血糖水平達到警報水平之前採取行動
  Allow you to take action before blood glucose level reaches alarming levels

Freestyle Libre		Dexcom		Medtronic	
趨勢箭咀 Trend Arrows	預計30分鐘內的改變 Estimated change in 30 minutes	趨勢箭咀 Trend Arrows	預計30分鐘內的改變 Estimated change in 30 minutes	趨勢箭咀 Trend Arrows	預計30分鐘內的改變 Estimated change in 30 minutes
			上升多於5.00mmol/L Increase > 5.00 mmol/L		上升多於5.00mmol/L Increase > 5.00 mmol/L
	上升多於3.00mmol/L Increase > 3.00 mmol/L		上升3.40 - 5.00mmol/L Increase 3.40 to 5.00 mmol/L		上升3.33 - 5.00mmol/L Increase 3.33 to 5.00 mmol/L
	上升1.80 - 3.00mmol/L Increase 1.80 to 3.00 mmol/L		上升1.60 - 3.40mmol/L Increase 1.60 to 3.40 mmol/L		上升1.67 - 3.33mmol/L Increase 1.67 to 3.33 mmol/L
	少於1.80mmol/L變化 Change less than 1.80 mmol/L		少於1.60mmol/L變化 Change less than 1.60 mmol/L		少於1.67mmol/L變化 Change less than 1.67 mmol/L
	下降1.80 - 3.00mmol/L Decrease 1.80 to 3.00 mmol/L		下降1.60 - 3.40mmol/L Decrease 1.60 to 3.40 mmol/L		下降1.67 - 3.33mmol/L Decrease 1.67 to 3.33 mmol/L
	下降多於3.00mmol/L Decrease > 3.00 mmol/L		下降3.40 - 5.00mmol/L Decrease 3.40 to 5.00 mmol/L		下降3.33 - 5.00mmol/L Decrease 3.33 to 5.00 mmol/L
			下降多於5.00mmol/L Decrease > 5.00 mmol/L		下降多於5.00mmol/L Decrease > 5.00 mmol/L

警報是甚麼？
What are alerts?

部份CGMS型號會對不同情況發出鳴聲和/或振動的警報
Some CGMS models have audible beep and/or vibration for different alerts

回應這些警報並採取行動是很重要的
It is important to pay attention to these alerts and take action

主要有以下幾種警報：
There are several types of alerts:

- 警戒警報 Threshold alerts:
  - 當葡萄糖水平達到預設的過高或過低警戒值時，便會發出警報
    Alarms for high or low glucose when a preset threshold glucose is reached
  - 緊急低葡萄糖警報 (Freestyle Libre除外)：原廠預設值為3.1mmol/L
    Urgent low value (except Freestyle Libre): device preset value is 3.1mmol/L
- 預測警報 Predictive alerts:
  - CGMS綜合之前的葡萄糖值來預測葡萄糖水平的上升或下降，當預測葡萄糖水平達到預設的過高或過低警戒值前，便會發出警報
    Alarms when glucose level is predicted to go low or high in the near future. CGMS utilizes data from past few glucose levels to predict this rise or fall of glucose level
- 速變警報 Rate-of-change alerts:
  - 血糖水平快速下降或上升時警報
    Alarms for rapid fall or rise in glucose levels
- 失聯警報 Signal loss alerts

*** 除緊急低葡萄糖外，用者可自行設置警報
User can preset alerts as required except urgent low alert

你的醫療團隊或會與你討論應使用甚麼葡萄糖警戒值
Your medical team may discuss with you on what glucose thresholds to use

我們的目標是甚麼及要如何達標？
What are our targets and how do we measure them?

糖尿病患者需每隔幾個月進行糖化血紅素 (HbA1c) 的血液檢查
People with diabetes routinely have blood test called haemoglobin A1c (HbA1c) every few month

我們的目標是有效地控制血糖，使HbA1c低於或等如7%
Our target is to optimize blood glucose control with HbA1c less than or equal to 7%

然而，糖化血紅素有以下限制
However, there are some limitations of HbA1c

- HbA1c只能反映過去3個月的平均血糖水平，並未能檢測到每日高/低血糖或葡萄糖水平的急速改變
  HbA1c only indicates the average blood glucose levels in the past 3 months. It does not detect daily high or low glucose, or rapid changes in glucose levels
- HbA1c不能提供足夠數據以調節藥物劑量
  HbA1c does not provide enough data to adjust insulin dosage
- HbA1c未能準確反映貧血、血紅蛋白病、缺鐵患者和孕婦的情況
  HbA1c is unreliable in patients with anaemia, haemoglobinopathies, iron deficiency and pregnancy

我如何解讀CGMS報告？
How do I interpret CGMS Reports?

所有CGMS均提供標準化報告，稱為動態葡萄糖概況 (AGP)
All CGMS provide standardized reports called Ambulatory Glucose Profile (AGP)

01 感應器使用率或CGMS有讀數時間百分比 Sensor usage/ % of time CGMS is active

» 最理想為不少於70%的時間
Ideally at least 70% of the time

02 葡萄糖管理指標 Glucose Management Indicator (GMI)

» 根據最少前兩星期CGMS的葡萄糖數據而估算的HbA1c水平
Estimated HbA1c level from CGMS glucose data in at least past 2 weeks

03 葡萄糖波幅 Glucose Variability

» 測量葡萄糖值高低波幅的程度。穩定的葡萄糖水平為 < 36%
Measures how far apart glucose values are. Stable glucose levels are defined as glucose variability < 36%

04 達標時率 Time In Range (TIR)

» CGMS提供的不只是平均值，它還能提供葡萄糖水平處於目標範圍內的時間
Rather than providing an average value of HbA1c, CGMS offers information on the percentage of time that glucose levels are within the target range

- TIR應在3.9至10mmol/L之間。在特別情況下TIR可能會有不同。例如，醫療團隊可能會建議幼兒設定更高的葡萄糖目標以避免低血糖
  TIR is set between 3.9 to 10mmol/L. This can vary in special circumstances e.g. in young toddlers, where medical team may suggest a higher target to avoid low blood glucose
- 建議的TIR為70%或以上（即每天等如或多於16.8小時），以對應HbA1c低於或等如7%
  The recommended TIR is 70% or higher (i.e. ≥ 16.8 hours a day) as this corresponds to HbA1c of ≤ 7%
- 其他範圍時率請參考附圖
  Please refer to the attached diagram for the percentage of time for other ranges

05 整體趨勢 Overall Trend

06 葡萄糖概況 Glucose Profile

» 將每日圖表組合成一天的圖片
Daily graphs are combined to make a one-day picture

大部份CGMS應用程式可輸入胰島素劑量、食物攝取量、運動和其他說明以用作解讀報告，讓家人和醫療團隊可以按報告進行相應調整。

Most CGMS apps allow users to enter details, for example, insulin doses, food intake, activities and special notes for interpretation. All these information will be integrated to the CGMS report, allowing the family and medical team to review and make adjustment accordingly.

AGP Report - 動態葡萄糖概況報告

Name :
D.O.B. :

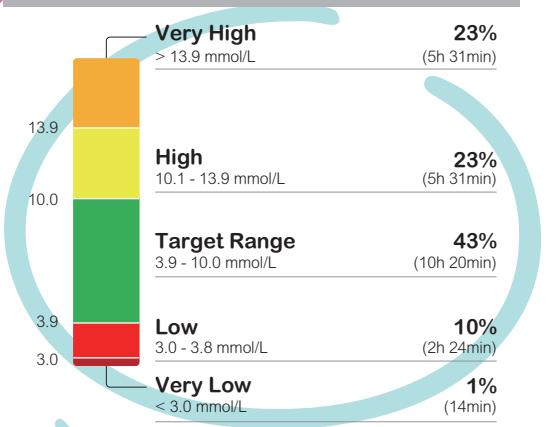
GLUCOSE STATISTICS AND TARGETS

28 March 2023 - 10 April 2023	14 Days
01 Time sensor active:	59%
Average Glucose	10.3 mmol/L
02 Glucose Management Indicator (GMI)	7.8% or 61 mmol/mol
03 Glucose Variability	57.2%

Goals for Type 1 and Type 2 Diabetes 一型及二型糖尿的目標

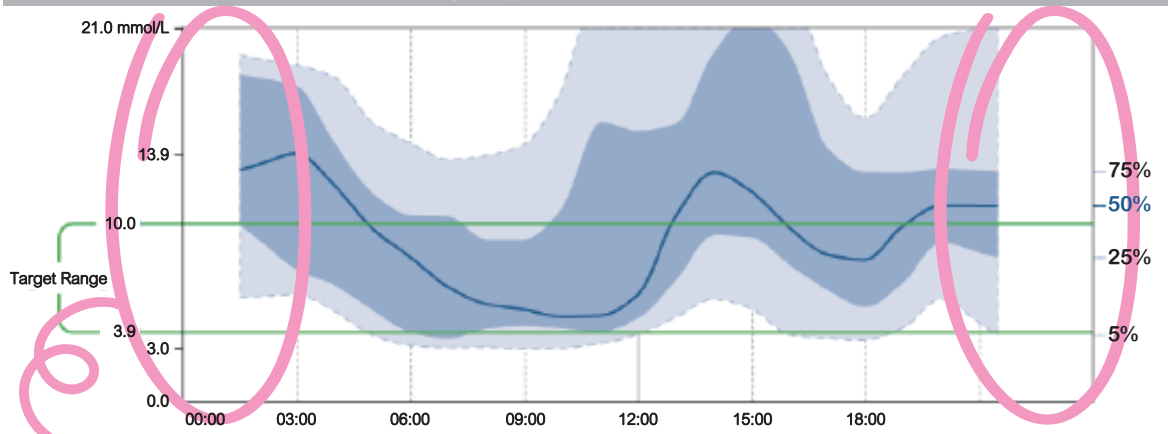
Glucose Range 血糖範圍	Targets % of Readings
3.9 - 10.0 mmol/L	> 70%
< 3.9 mmol/L	< 4%
< 3.0 mmol/L	< 1%
> 10.0 mmol/L	< 25%
> 13.9 mmol/L	< 5%

04 TIME IN RANGES



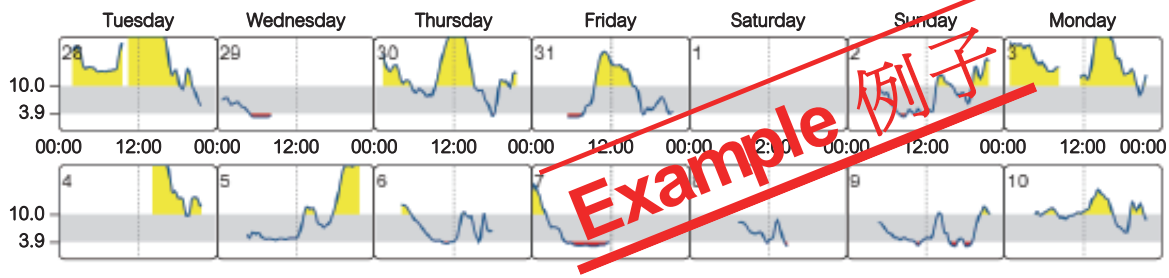
TIR <70%, low >4%, very low ≥1%:
有改善空間 room for improvement

05 AMBULATORY GLUCOSE PROFILE (AGP) - OVERALL TREND



某些CGMS型號可能會因信號接收問題或沒有定期掃瞄而導致信號中斷
Data loss could be due to connectivity issues and lack of regular scanning in some models

06 DAILY GLUCOSE PROFILES



植入CGMS小貼士及皮膚護理
Tips for applying CGMS and skin care

植入CGMS感應器時
When applying CGMS sensor

- CGMS應植入到有足夠皮下脂肪的位置如手臂、腹部或臀部，不同型號的建議部位和年齡限制請參考第8頁列表
  CGMS should be inserted to subcutaneous fat beneath the skin, i.e. arm, abdomen or buttock area. For the recommended sites and approved age for different models, please refer to the table on p8
- 避免疤痕、身體摺痕和/或褲頭/腰帶位
  Avoid scars, body creases and/ or pant lines/ belt lines
- 避開睡覺時經常受壓的地方：CGMS發射器受壓可能出現假低血糖現象
  Avoid areas that you usually sleep on: compression on the CGMS sensor may result in falsely low readings
- 避免腫脹部位
  Avoid swollen tissues
- 使用肥皂和清水清潔皮膚，以去除身上的乳液和油脂
  Clean the skin with soap and water to remove lotion and oil
- 在植入CGMS感應器之前確保皮膚完全乾爽
  Make sure the skin is completely dry before inserting the CGMS sensor
- 可以在感應器上貼上膠布或繫上繃帶以防止脫落
  Extra tape or bandage can be applied over the sensor for better security
- 更換感應器時需轉換位置
  Rotate sites when changing to a new sensor

皮膚不適或痕癢是CGMS使用者常見的問題
Skin irritation or itchiness is one of the most frequent problems among CGMS users

- 在植入感應器前可以塗上護膚物料保護皮膚
  Skin prep (or skin barrier) can be applied to the skin prior to insertion of sensor

- 可使用嬰兒油或各種油性產品幫助除下感應器及其周圍的膠布
  During removal, baby oil or similar products can help peel the tape surrounding the sensor

- 若CGMS植入位置持續發紅或腫脹，請通知醫療團隊
  Inform the medical team if redness or swelling persists in areas of CGMS insertion

植入後出血
Bleeding after insertion

- 若有流血不止，請拆下感應器
  If the bleeding does not stop, remove the sensor

使用CGMS如何幫助控制運動期間的葡萄糖水平？
How does CGMS help in managing glucose levels during exercise?

運動期間血糖水平可能會因應運動強度和持續時間有更大的波幅
Blood glucose levels may fluctuate more during exercise, depending on the intensity and duration of exercise

血糖水平會因應不同的運動類型而波動，一般來說：
Blood glucose levels also fluctuate with the types of exercise, in general:

- 帶氧運動（例如步行、慢跑和騎單車）：血糖下降
  Aerobic exercise (e.g. walking, jogging, and cycling): drop in blood glucose
- 無氧運動（例如短跑和舉重）：血糖升高
  Anaerobic exercise (e.g. sprinting and power-lifting): rise in blood glucose

兒童在運動後也有出現低血糖的風險，因此需要更頻繁地監測血糖水平。
Children are also at risk of low blood glucose in the post-exercise period. Close monitoring of blood glucose levels is necessary.

使用CGMS可以持續地監測運動時及運動後的葡萄糖水平及變化，觀察趨勢箭咀可幫助預防低血糖，包括夜間時間（詳細請參考第17-20頁列表）
CGMS can help in monitoring the glucose levels during and after exercise. Trend arrows also help to prevent low blood glucose, including night time. (For details, please refer to the table on p17-20)

CGMS感應器和發射器是防水的，並不阻礙水上活動
CGMS can be used during water sport as sensors and transmitters are waterproof

不同的CGMS型號會有不同的水深和時間限制：
Immersion depths and time vary with different CGMS models:

- Freestyle Libre：不可在水深超過1米多於30分鐘
  Freestyle Libre: Do not immerse deeper than 1 meter for up to 30 minutes
- Dexcom：不可在水深超過2.4米多於24小時
  Dexcom: Do not immerse deeper than 2.4 meters for up to 24 hours
- Medtronic：不可在水深超過2.4米多於30分鐘
  Medtronic: Do not immerse deeper than 2.4 meters for up to 30 minutes

使用CGMS專用防水膠布可以提供額外保護
Waterproof tapes for CGMS can be applied to the sensor for extra protection.

不同組別的一型糖尿病兒童和青少年帶氧運動的葡萄糖值目標
Sensor glucose targets for different groups of children and adolescents with Type 1 Diabetes having aerobic exercise

運動時，葡萄糖反應因個人而異，以下圖表只供參考（建議指引不適用於半閉環系統胰島素泵使用者）
Glucose response varies with individuals during exercise. The following chart is for reference only. (These recommendations are not applicable to hybrid closed-loop insulin pump system)

一般而言，風險組別分組基於（1）運動習慣和（2）低血糖風險
In general, risk group stratification is based on (1) Exercise Habits and (2) Risk of Hypoglycaemia

運動習慣 Exercise Habits

一星期有多少次45分鐘或以上運動
Sessions of exercise ≥ 45 mins per week

組別 Group	次數 Frequency
A	0
B	1-2
C	> 2

低血糖風險 Risk of Hypoglycaemia

組別 Group	低血糖風險 Risk of Hypoglycaemia	能夠意識到低血糖 Awareness of Hypoglycaemia		6個月內出現嚴重低血糖 Severe Hypoglycaemia in last 6 months		感應器讀數 < 3.9mmol/L CGM time < 3.9mmol/L
A	高風險 High risk	不能夠 Imparied	和/或 and/or	有 Yes	和/或 and/or	> 8%
B	中風險 Moderate risk	能夠 Aware		沒有 No		4-8%
C	低風險 Low risk	能夠 Aware		沒有 No		< 4%

帶氧運動前 Before aerobic exercise

<table>
<tr><th>組別 C
Group C</th><th>組別 B
Group B</th><th>組別 A
Group A</th><th>趨勢箭咀方向
Trend Arrow Direction</th><th>預計運動後血糖會下降
Expected Decrease in Sensor Glucose</th></tr>
<tr><td colspan="3">>15.0 mmol/L AND blood ketones +ve
(血酮+)</td><td>  </td><td>不可運動，跟從處理血酮方案，多飲水
No exercise, follow ketone rules and drink water</td></tr>
<tr><td colspan="3" rowspan="3">>15.0 mmol/L AND no blood ketones
(血酮正常)</td><td>  </td><td>可考慮補針，可開始運動
Consider insulin correction, can start exercise</td></tr>
<tr><td>  </td><td>可開始運動
Can start exercise</td></tr>
<tr><td>  </td><td>可開始運動
Can start exercise</td></tr>
<tr><td>10.1-15.0
mmol/L</td><td>11.1-15.0
mmol/L</td><td>12.1-15.0
mmol/L</td><td>  </td><td>可開始運動
Can start exercise</td></tr>
<tr><td rowspan="2">7.0-10.0
mmol/L</td><td rowspan="2">8.0-11.0
mmol/L</td><td rowspan="2">9.0-12.0
mmol/L</td><td>  </td><td>可開始運動
Can start exercise</td></tr>
<tr><td>  </td><td>補充~10g碳水化合物(0.3g/kg)後可開始運動
~10g carbohydrates (0.3g/kg), can start exercise</td></tr>
<tr><td rowspan="4">5.0-6.9
mmol/L</td><td rowspan="4">5.0-7.9
mmol/L</td><td rowspan="4">5.0-8.9
mmol/L</td><td>  </td><td>補充~5g碳水化合物(0.2g/kg)後可開始運動
~5g carbohydrates (0.2g/kg), can start exercise</td></tr>
<tr><td>  </td><td>補充~10g碳水化合物(0.3g/kg)後可開始運動
~10g carbohydrates (0.3g/kg), can start exercise</td></tr>
<tr><td>  </td><td>補充~15g碳水化合物(0.4g/kg)及延後做運動
~15g carbohydrates (0.4g/kg), delay exercise</td></tr>
<tr><td>  </td><td>因應個人需要而補充碳水化合物及延後運動
Carbohydrates intake based on individual needs, delay exercise</td></tr>
<tr><td colspan="3"><5.0 mmol/L</td><td>  </td><td>因應個人需要而補充碳水化合物及延後運動
Carbohydrates intake based on individual needs, delay exercise</td></tr>
</table>

帶氧運動期間 During aerobic exercise

<table>
<tr><th>組別 C
Group C</th><th>組別 B
Group B</th><th>組別 A
Group A</th><th>趨勢箭咀方向
Trend Arrow Direction</th><th>預計運動後血糖會下降
Expected Decrease in Sensor Glucose</th></tr>
<tr><td colspan="3">>15.0 mmol/L AND blood ketones +ve (血酮+)</td><td>↑ ↗ → ↘ ↓</td><td>停止運動，跟從處理血酮方案，多飲水
Stop exercise, follow ketone rules and drink water</td></tr>
<tr><td colspan="3" rowspan="2">>15.0 mmol/L AND no blood ketones (血酮正常)</td><td>↑ ↗</td><td>繼續運動
Continue exercise</td></tr>
<tr><td>→ ↘ ↓</td><td>繼續運動
Continue exercise</td></tr>
<tr><td>10.1-15.0 mmol/L</td><td>11.1-15.0 mmol/L</td><td>12.1-15.0 mmol/L</td><td>↑ ↗ → ↘ ↓</td><td>繼續運動
Continue exercise</td></tr>
<tr><td>7.0-10.0 mmol/L</td><td>8.0-11.0 mmol/L</td><td>9.0-12.0 mmol/L</td><td>↑ ↗ → ↘ ↓</td><td>繼續運動
Continue exercise</td></tr>
<tr><td rowspan="4">5.0-6.9 mmol/L</td><td rowspan="4">5.0-7.9 mmol/L</td><td rowspan="4">5.0-8.9 mmol/L</td><td>↑ ↗</td><td>繼續運動
Continue exercise</td></tr>
<tr><td>→</td><td>補充~10g碳水化合物(0.3g/kg)後繼續運動
~10g carbohydrates(0.3g/kg),
continue exercise</td></tr>
<tr><td>↘</td><td>補充~15g碳水化合物(0.4g/kg)後繼續運動
~15g carbohydrates(0.4g/kg),
continue exercise</td></tr>
<tr><td>↓</td><td>補充~20g碳水化合物(0.4-0.5g/kg)後繼續運動
~20g carbohydrates(0.4-0.5g/kg),
continue exercise</td></tr>
<tr><td colspan="3">4.0-4.9 mmol/L</td><td>↑ ↗ → ↘ ↓</td><td>停止所有運動，考慮篤手指確定血糖，因應個人需要補充碳水化合物，當葡萄糖回升至5.0以上及趨勢箭咀為↑或↗可重啟運動
Stop all exercise, consider confirmatory finger-prick, carbohydrates intake based on individual needs. Can restart exercise when sensor glucose ≥5.0mmol/L and tread arrow is ↑ or ↗</td></tr>
<tr><td colspan="3"><4.0 mmol/L</td><td>↑ ↗ → ↘ ↓</td><td>停止所有運動，篤手指確定血糖，因應個人需要補充碳水化合物
Stop all exercise, confirmatory fingerstick, carbohydrates intake based on individual needs</td></tr>
</table>

帶氧運動後 After aerobic exercise

- 因運動可令你的身體對胰島素更加敏感，運動後24小時內血糖會降低，因此要更頻繁地監測血糖水平
  Exercise can lower your blood glucose for up to 24 hours after your workout by making your body more sensitive to insulin. Therefore, it is important to closely monitor your blood glucose after exercise.

- 如當天曾做運動（尤其是在黃昏或之後進行），可考慮在睡前補充額外碳水化合物，以防止夜間出現低血糖
  If exercise is performed in the late afternoon/evening, consider taking extra carbohydrates before bed to prevent nocturnal hypoglycaemia.

我可以攜帶CGMS去旅行嗎？
Can I travel with CGMS?

請向你的醫療團隊索取証明信件，說明你的情況以及所需要攜帶的血糖用品。CGMS可以在飛行期間佩戴。

Always ask for a letter from your medical team stating your condition and the necessary glucose-monitoring equipment you need to bring on board. CGMS can be worn during flights.

但有些額外事項是需要注意的
However, there are a few extra things to take note of when travelling with CGMS

- 全身掃描儀也可以是一種X光。在通過掃描之前請移除感應器和傳送器，或要求另一種檢查方式代替全身掃描儀
  Whole body scanner could be a form of X-ray. Remove the sensor and transmitter prior to the scan or request an alternative screening process
- 在檢查手提行李時，讓工作人員以目視檢查所有儀器，不要使用X光安檢機
  During hand/carry-on luggage examination, request the security personnel to visually inspect the equipment, do not send your devices through the X-ray machine
- 請將你的智能手機設置為飛行模式並保持藍牙或NFC開啟。如果你使用的是接收器，請同時開啟接收器
  Set your smartphone app to airplane mode and keep the Bluetooth or NFC on. If you are using a receiver, leave your receiver turned on as well
- 抵達目的地時，根據當地時間更改接收器或智能手機的時間
  Upon arrival, adjust the time of the receiver or your smartphone to the corresponding time zone
- 請在手提行李中隨身帶備足夠的胰島素筆、針頭、額外的感應器和傳送器、升糖素、血糖試紙和血糖機
  Do remember to bring enough insulin pens and pen needles, extra sensors with transmitter, glucagon, finger-prick test strips and your blood glucose meter in your hand carry luggage

使用CGMS有哪些注意事項？
What are the precautions for using CGMS?

生病時 Sick days

- 孩子生病時需要更頻繁地監測葡萄糖水平
  More frequent monitoring of glucose levels is necessary when a child is sick
- 當讀數過高或過低時，需要篤手指確認
  Always do confirmatory finger-prick tests when sensor glucose readings are at extreme ranges
- 某些藥物（例如撲熱息痛）可能導致葡萄糖讀數偏高
  Certain medication (e.g. paracetamol) may falsely raise your sensor glucose readings

醫療程序 Medical procedure

- 進行X光、CT掃描、MRI和其他影像檢查時不可佩戴CGMS
  Do not wear a CGMS when undergoing X-ray, CT scan, MRI and other imaging examinations
- 當你佩戴CGMS進行使用某些止血設備的手術時，請務必通知你的醫生
  Always notify your doctor when you have to undergo an operation as CGMS needs to be removed if some haemostatic devices are being used

準確性 Accuracy

- 首24小時或會發生假低現象
  Falsely low readings in the first 24 hours
- 血糖快速變化時，相對的感應器葡萄糖值差異較大
  When there is a rapid change in blood glucose, the difference between blood glucose value and sensor glucose value becomes greater

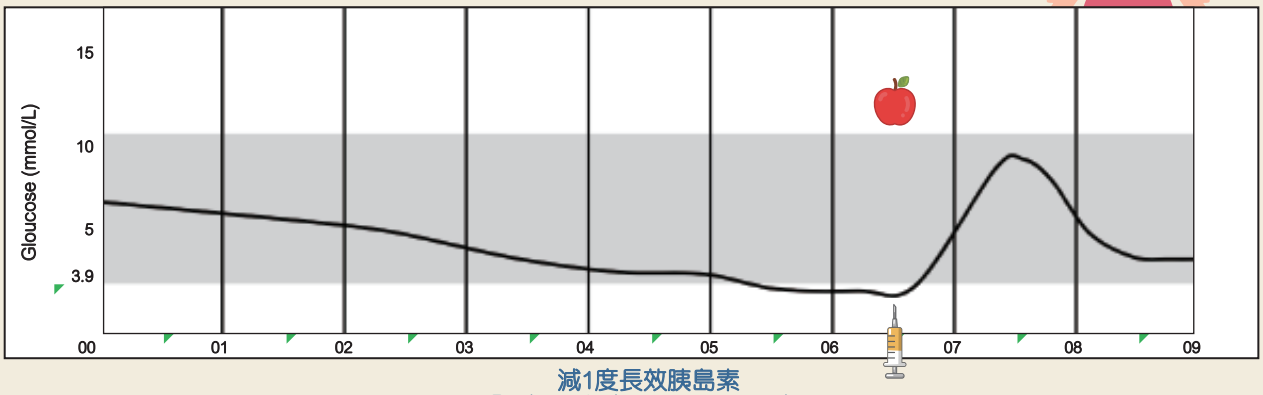
生活例子 Real-life examples

只供闡述用途，所有劑量更改需由醫護團隊確定
For illustration only, all dosage changes should be advised by medical team

例子1：午夜血糖下降至清晨低血糖
Example 1: Falling nocturnal blood glucose with low blood glucose in the morning

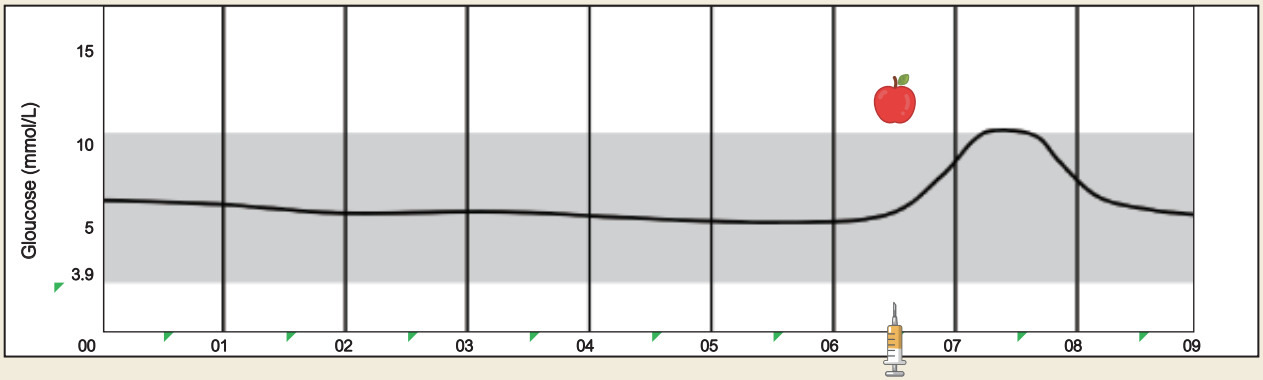
- 盈盈午夜時持續血糖下降，至清晨低血糖
  Ying Ying's blood glucose dropped overnight and resulted in low blood glucose early in the morning
- 解決方案：減1度長效胰島素
  Solution: Reduce 1 unit of long acting insulin

前 / Before



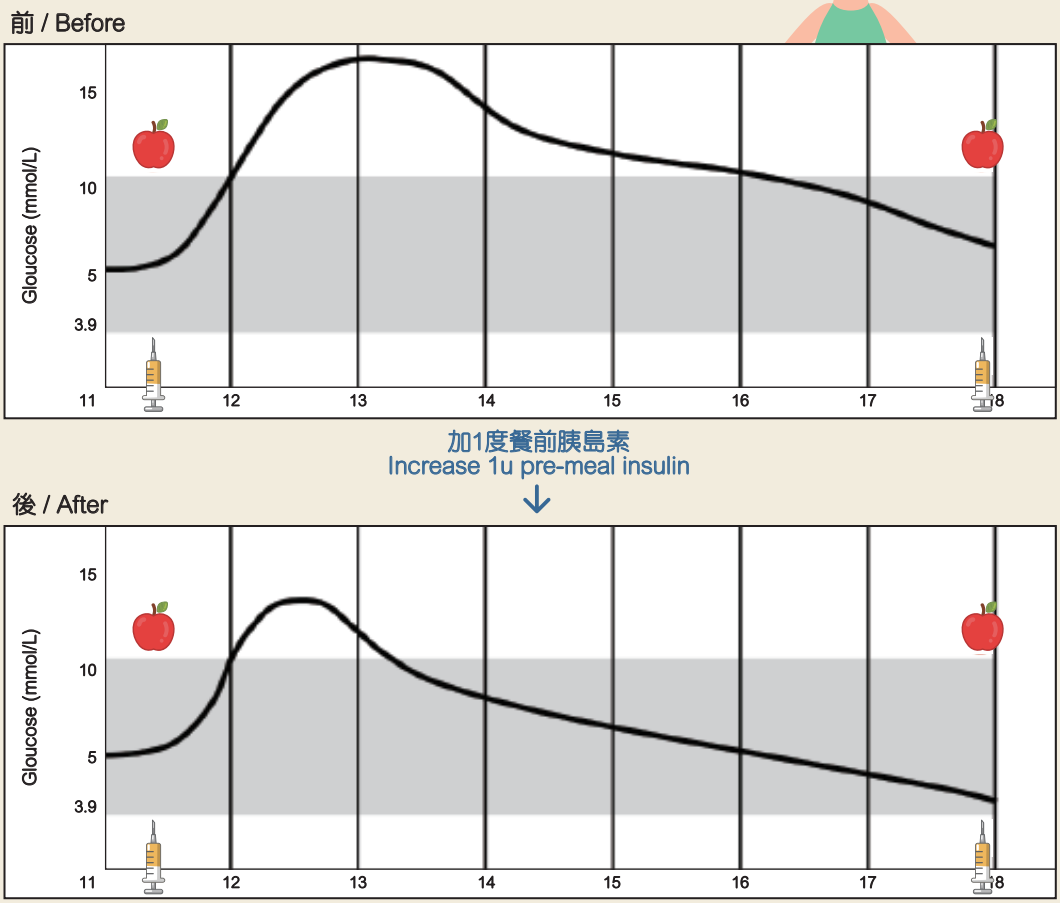
減1度長效胰島素
Reduce 1u long acting insulin

後 / After



例子2：晚餐前血糖正常但午餐後血糖持續過高
Example 2: Normal pre-dinner blood glucose but post-lunch blood glucose excursion

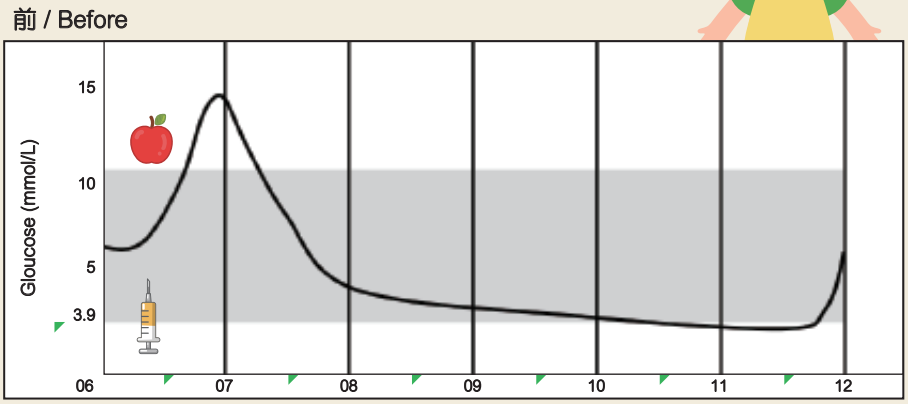
- 思思午餐前篤手指血糖正常，2小時後血糖升至16mmol/L，晚飯前回落正常水平
  Ceci’s pre-lunch finger-prick test was normal but it rose to high level at 16mmol/L after 2 hours, and dropped before dinner
- 解決方案：加1度餐前速效胰島素
  Solution: Increase 1 unit pre-meal fast-acting insulin

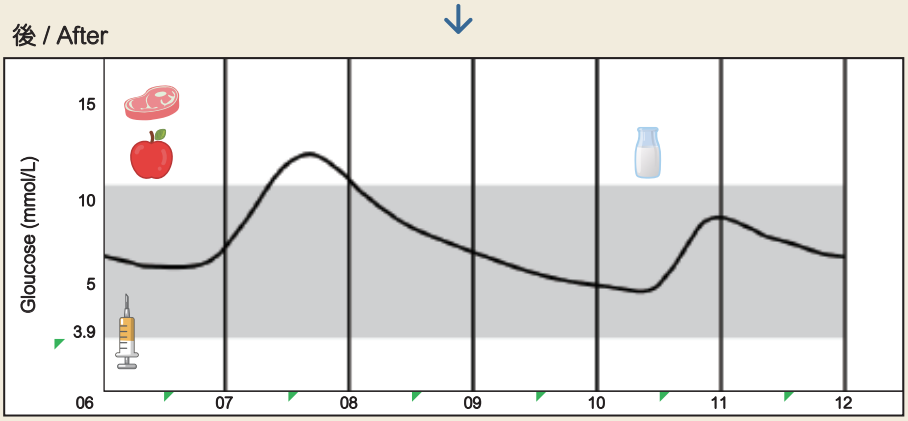


例子3：早餐後高血糖，但午餐前偏低

Example 3: High blood glucose after breakfast, but low blood glucose before lunch

- 朗朗早餐後1小時血糖升至很高，但在午餐前降到了臨界水平（有時甚至低於4mmol/L）
  Long Long's blood glucose was high 1 hour after breakfast, but it dropped to borderline low level before lunch (sometimes even lower than 4mmol/L)
- 解決方案 Solution
  - 早餐前15分鐘注射速效胰島素
    Give fast-acting insulin 15 minutes before breakfast
  - 增加早餐高蛋白質或纖維食物
    Add food with higher protein or fibres content at breakfast
  - 於早午餐之間吃小食
    Take snacks between breakfast and lunch





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香港兒童醫院內分泌及糖尿組的病人及家屬
Patients and families of Endocrine and Diabetes Team,
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溫馨提示：技術與時俱進，未來可能會有進一步的細節修改
Warm reminder: Technology keeps improving with time and there might be further modifications in the future

November 2023

References:

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2) Glucose management for exercise using continuous glucose monitoring (CGM) and intermittently scanned CGM (isCGM) systems in type 1 diabetes: position statement of the European Association for the Study of Diabetes (EASD) and of the International Society for Pediatric and Adolescent Diabetes (ISPAD) endorsed by JDRF and supported by the American Diabetes Association (ADA). Pediatric Diabetes. 2020 Dec;21(8):1375-1393

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