Management and Technologies in the In-patient Environment

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t·r·e·n·d™ DIABETES

Leicester Diabetes Centre

So what do we consider to be technologies?

In Patient Diabetes Management and Tech

CGM

CSII

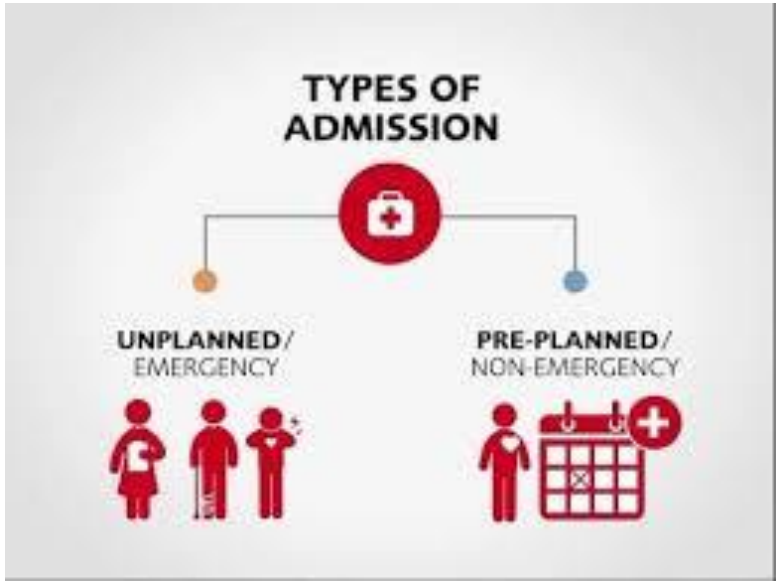
HCL

But guidance also suggests we consider ……..

Ok so lets consider some reasons for hospital admission

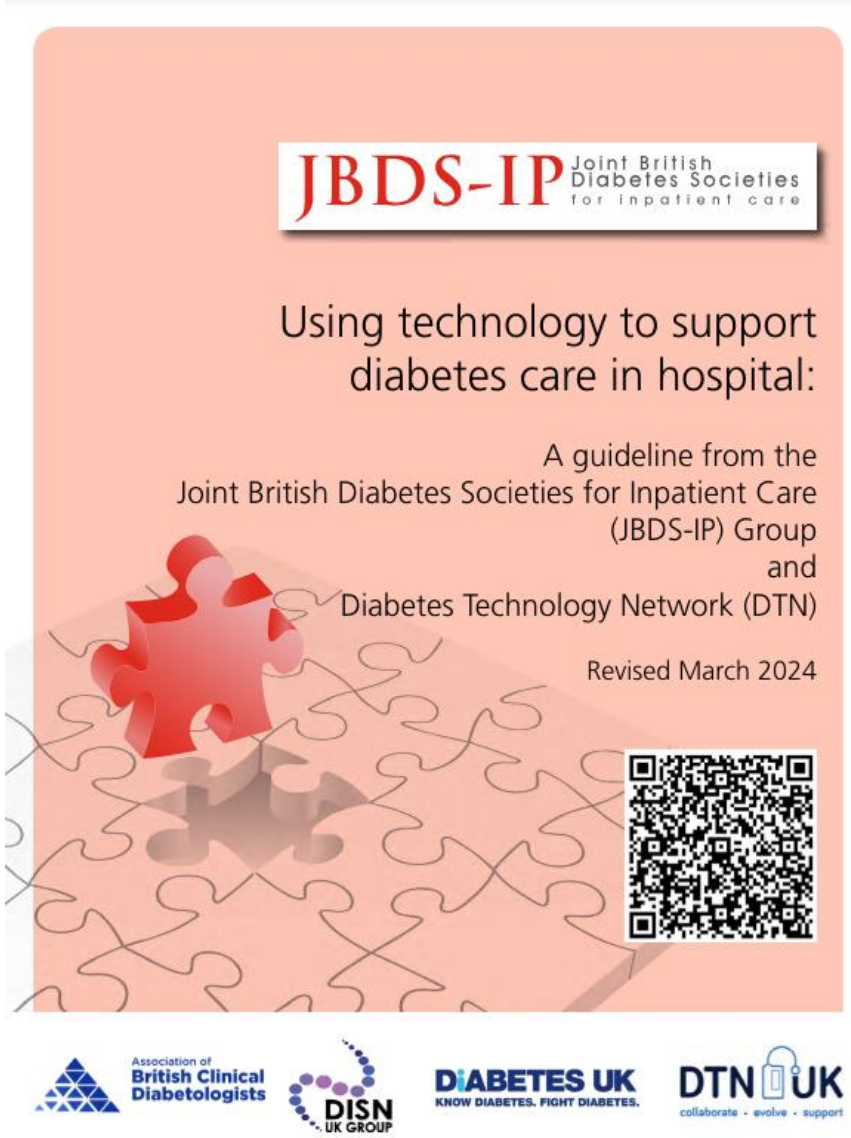
Reasons for Admission

- Acute diabetes emergency (Severe Hypo, DKA / HHS)
- Intercurrent illness
- Planned procedure
- Pregnancy / delivery



So what guidance to we have to support us?

Best practice guidance:



https://abcd.care/sites/default/files/resources/CSII_DTN_FINAL%20210218.pdf

https://abcd.care/sites/default/files/resources/JBDS_20_Using_Technology_to_Support_Diabetes_Care_in_Hospital_1.pdf

How would people in none specialist areas know what the technologies are?

Have you seen these? Do you use them?

RCEM Royal College of Emergency Medicine

ABCD Association of British Clinical Diabetologists

Safety Flash

March 2022

CGM device

CGM device

Insulin pump

Can you tell the difference?

Increasing numbers of people, especially those with type 1 diabetes, are using wearable diabetes technology. It is important to be able to distinguish between the 2 main types of technology people use:

- **Insulin pumps** deliver a constant infusion of rapid acting insulin via a cannula under the skin. There are 2 main types of insulin pump:
  - Patch pumps, where the cannula is integral to the pump unit. These are controlled by a separate handset. ***There is a risk these can be confused with continuous glucose monitors***.
  - Tethered pumps, where the pump unit is connected to the cannula via tubing.
- **Continuous glucose monitors**, which give continuous glucose readings from measurements taken from a subcutaneous sensor. ***There is a risk these can be confused with patch pumps***.

If a person with diabetes, particularly type 1 diabetes, is admitted to hospital - ask if they use any wearable diabetes technology. If they are unconscious, make sure you check them for wearable diabetes technology – usually worn on the arm or the abdomen but sometimes the thighs or buttocks.

If hypoglycaemia is present and the person is unconscious remove any device which may be administering insulin – if you are unsure of the device consider removing it as this is the safest option

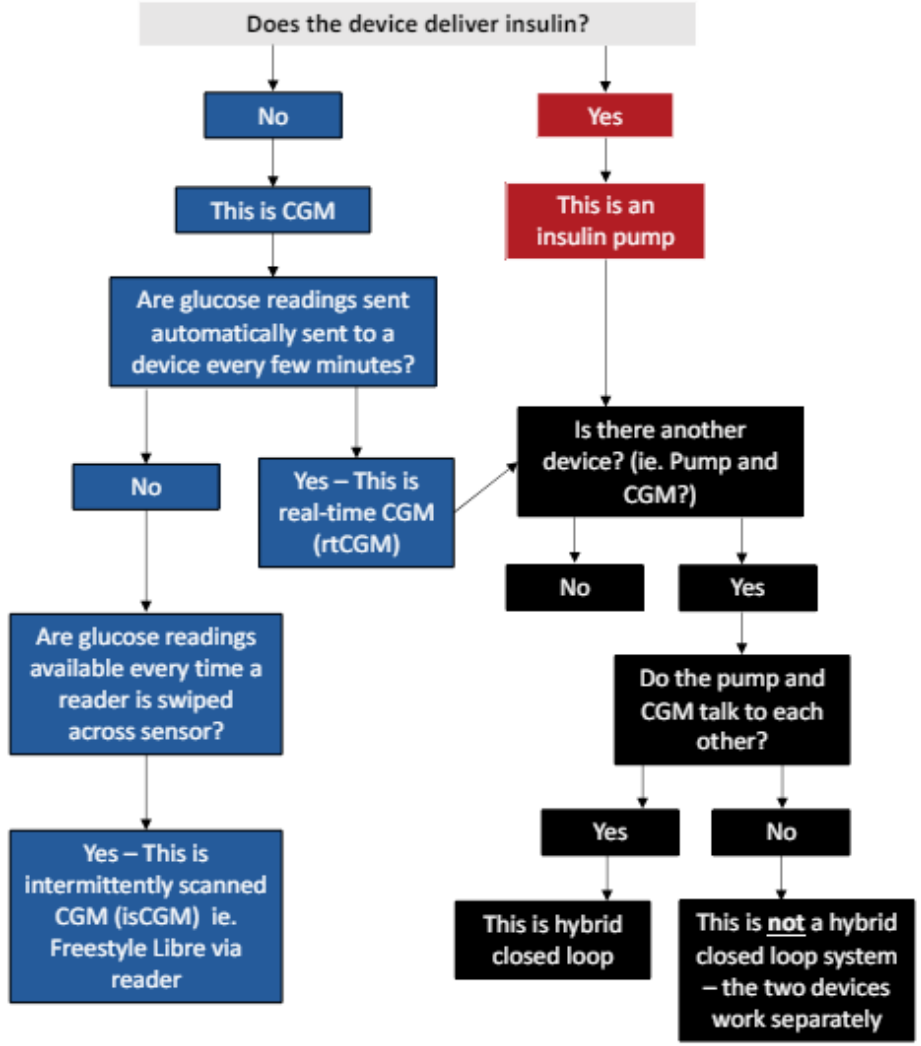
- If removing an insulin pump there is a risk of DKA unless insulin is administered in another way (e.g. variable rate intravenous insulin infusion)

If hyperglycaemia is present and the person is unconscious insulin delivery may have been interrupted and there is a risk of DKA. Alternative insulin delivery needs to be considered

Don't discard any devices that are removed as they are expensive and may be needed again

For further information on managing insulin pumps in people admitted to hospital, click here. If in doubt, please ask your local diabetes team for help

For other RCEM issued Safety Flashes and Safety Newsflashes see: https://rcem.ac.uk/safety-3/



What are the target glucose levels?

Are there additional considerations?

If BG > 16mmol/l for more than 2hrs on pump – swap it out

JBDS-IP inpatient glycaemic target 6 - 10 mmol/L

(in elderly/frail, aim for 6 - 12 mmol/L)

Diabetes tech targets in hospital

Aim for no hypoglycaemia episodes and minimise hyperglycaemia

If well in hospital, then can use outpatient time in range target 3.9 - 10 mmol/L

LOW ALERT
set at 4 or 5 mmol/L

consider treating to prevent hypoglycaemia (especially if downward arrow on CGM)

HIGH ALERT
set at 15 – 18 mmol/L

consider extra insulin

So what about using CGM in hospital environments?

Best Practice

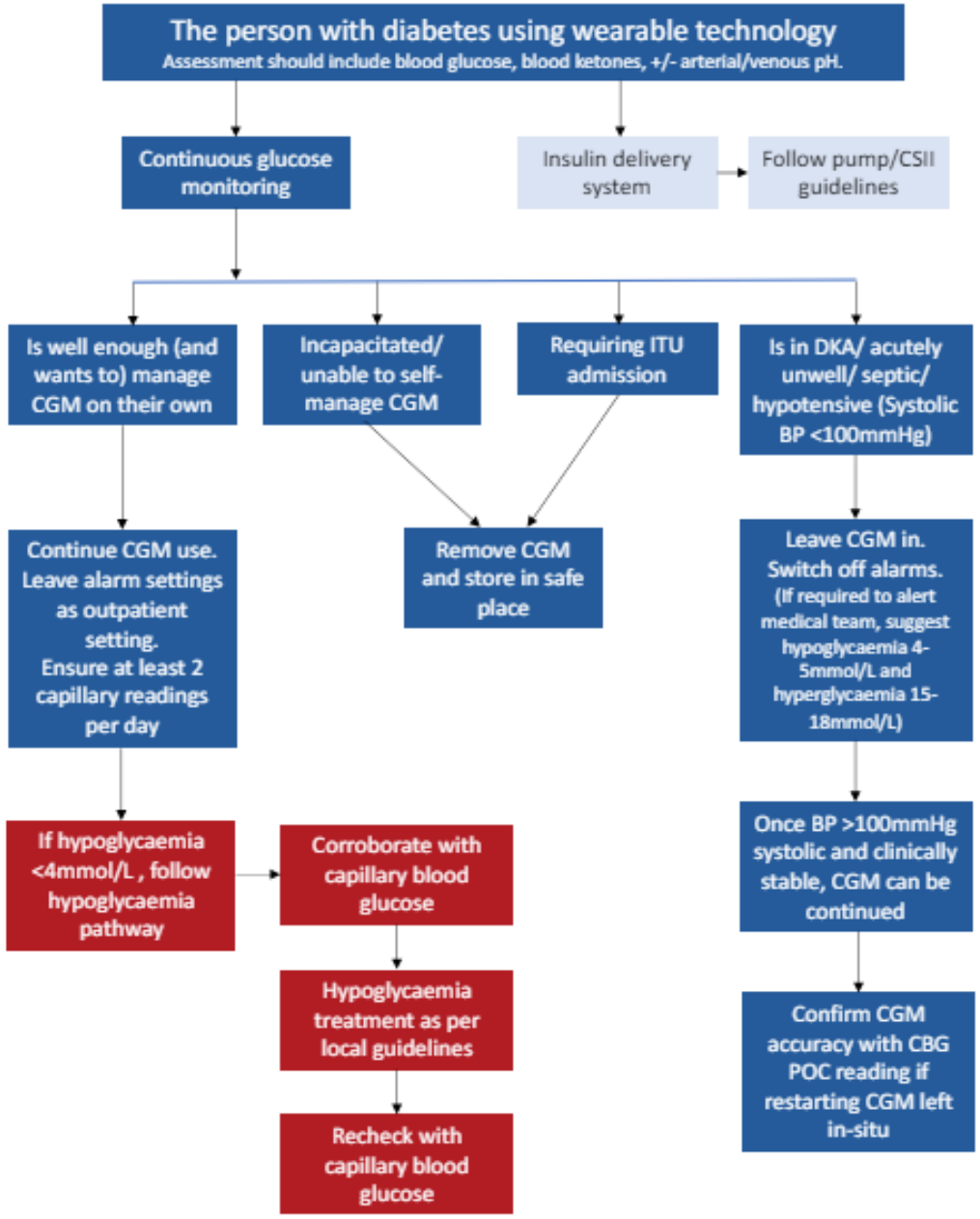
- Safety in most ward situations – **2 CBG per day / review of data / do symptoms match?**
- Concerns for those with low BP, on ITU (revert to SBGM in acutely unwell - (i.e. hypotensive BP <100mmHg)
- CPR – removal where appropriate
- Oedema or cellulitis
- Compression (especially in prone positions)

Situations to ALWAYS check fingerstick CBG whilst using a CGM device:
• To confirm hypoglycaemia AND monitor recovery from hypoglycaemia
• If symptoms do not match sensor glucose (e.g., if symptoms of hypoglycaemia are present but the sensor glucose reading is normal)
• If the sensor reading seems unlikely in the circumstances
• If the sensor reading is unreliable or obviously erroneous (e.g. no reading, or no arrow)
• If required for calibration
• During and after exercise (e.g. after extensive physio session)
• When following 'sick day rules' or 'rules for management of unexplained hyperglycaemia'

Other considerations:

- EOL
- Storage if removed
- Replace or remove?

Best Practice : CGM Algorithm



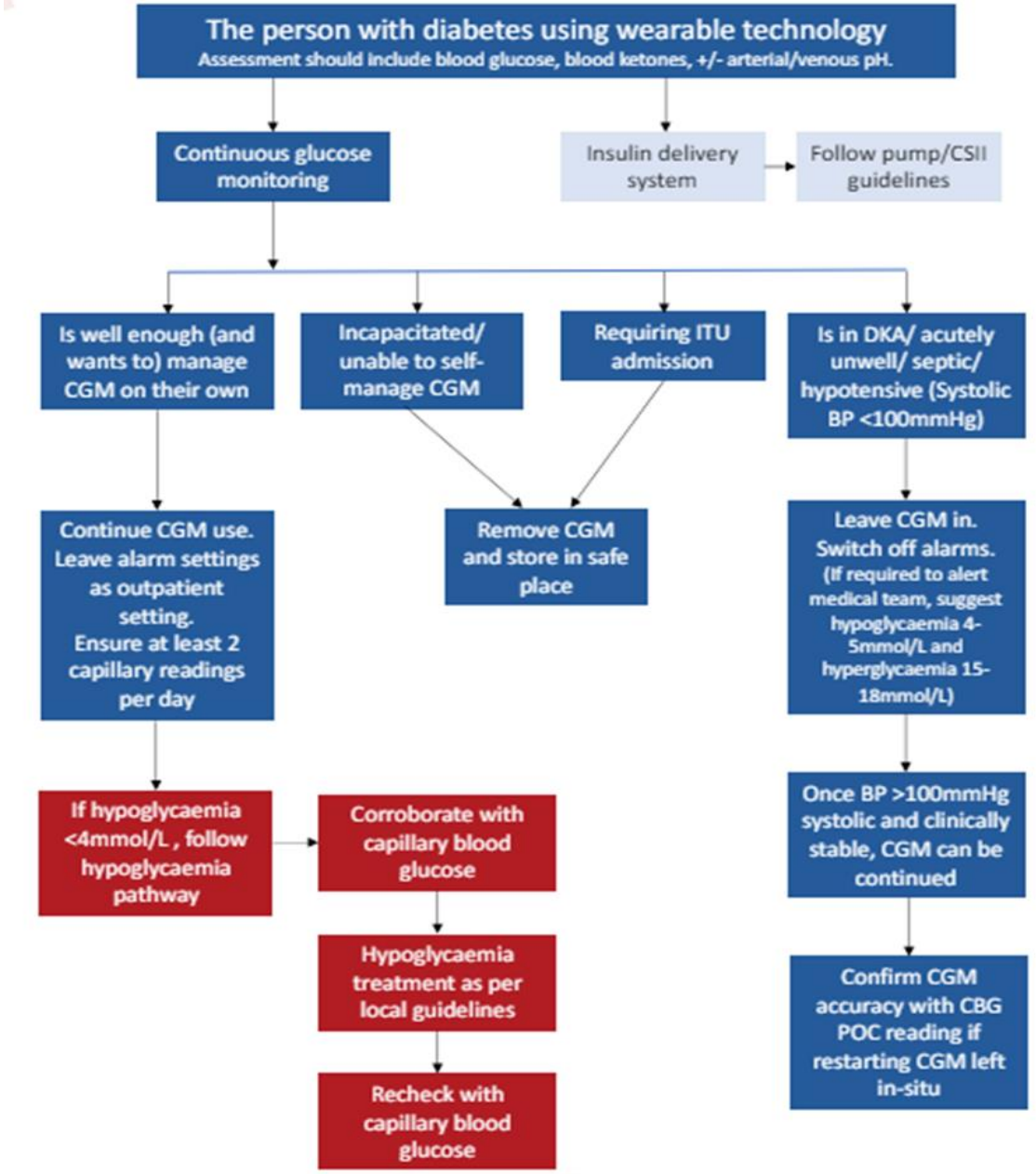
So lets think about insulin pump therapy

True or False

- Insulin pumps are rare?
- Insulin pumps do all the work?
- Individuals need high levels of self management skills?
- Insulin pump users have to be able to carb count?
- People with additional learning needs or support requirements can not use insulin pump therapy?
- Insulin pumps are dangerous and increase the risk of acute diabetes complications?
- Insulin pump have proven benefits in reducing glycaemic variance?

So what about CSII use in hospital environments?

Best Practice:



Risks:

- Cannula failure
  - Infrequent set changes
  - Dislodgment / kinking
  - Infrequent BG / ketone monitoring
- Miscalculation of insulin or Carbohydrates
- In ability to self manage insulin pump
- Misjudgement of activities

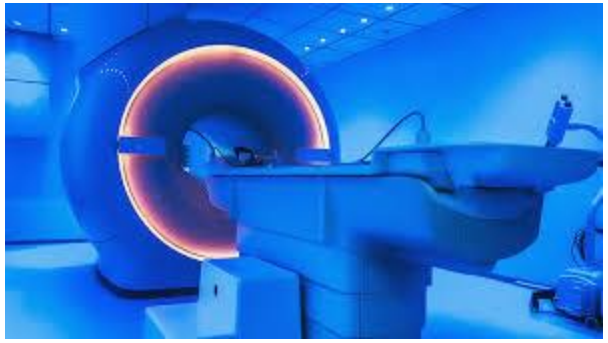
Consider

- Reverting to insulin injections
- Calculate doses → look at total daily dose on the pump
- Patient SHOULD have an emergency supply of pen insulin

MRI / CT Scan

Consider

- Length of procedure
- Requirement of removal of tech (keep in a safe place)
- The use VRII or alternate insulin delivery and glucose monitoring



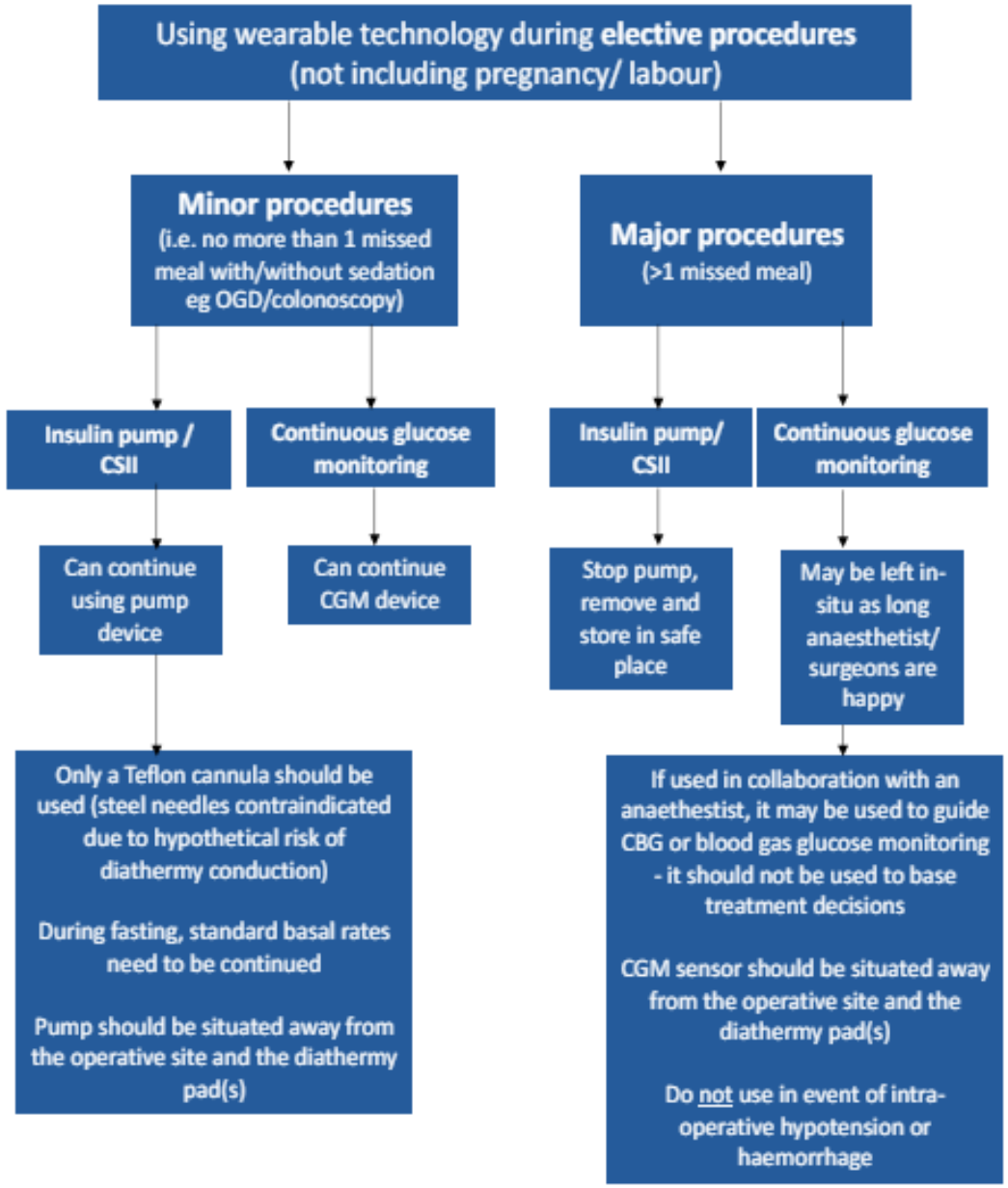
Contraindications .....

Contraindications to insulin pump therapy use in hospital
• Impaired level of consciousness or confusion
• Critical illness requiring intensive care/ high dependency care
• Diabetic ketoacidosis or hyperosmolar hyperglycaemic state
• During MRI
• Psychiatric illness or suicidal ideation
• The individual is unable to use hands and/or physically manipulate pump due to medical condition
• The individual is unwilling to participate in diabetes self-management, or share pump manage-ment decisions with hospital clinical staff
• Lack of pump supplies or mechanical pump malfunction
• Lack of trained healthcare providers or available diabetes specialists to supervise pump therapy
• Medical team decision for health and safety of the individual

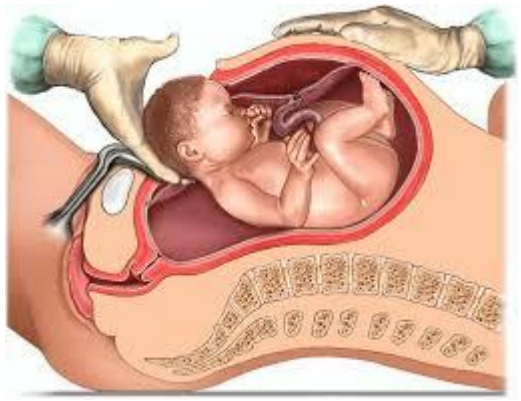
Adapted from Umpierrez GE et al, Diabetes Care. 2018;41(8):1579-1589 and Yeh et al. Curr Diab Rep. 2021;21(2):7.

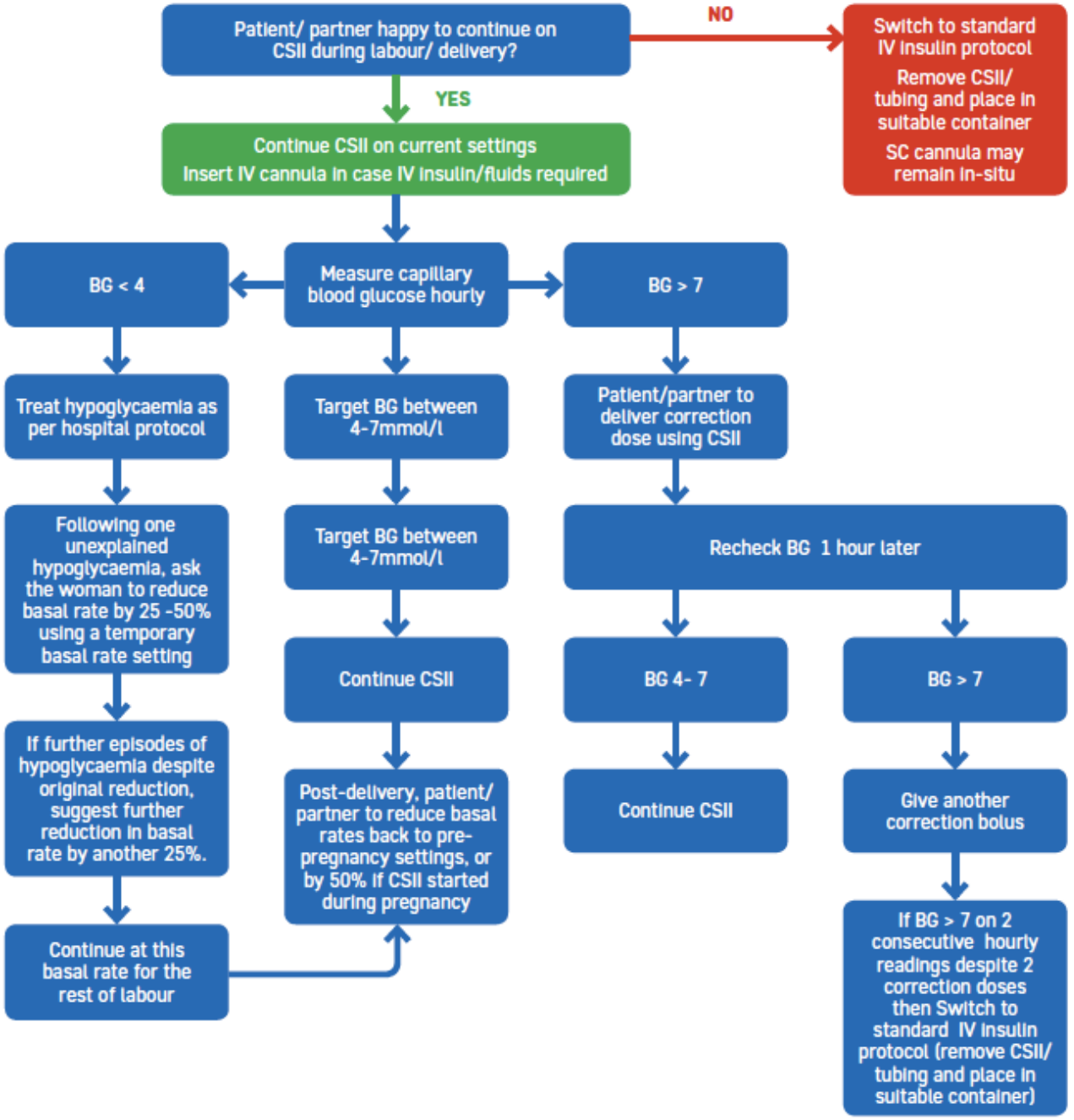
Best Practice: Surgery

- If blood glucose<4, follow local hypoglycaemia protocol; re-test every 10-15 mins. Post hypo recovery, test glucose every 30 min until end of procedure
- Leave CSII in place and do not attempt to adjust settings
- If CSII alarms during procedure, don't try to rectify; leave CSII in place, monitor blood glucose every 30mins.
- If alarm becomes intrusive, or patient has more than one hypo, remove CSII and tubing (do not attempt to switch off CSII), Label CSII & store in secure place. Start VRII.



Best Practice: Labour (Planned C-Section)





If insulin pump stopped

- Consider leaving SC cannula in place (Omnipod / **Medtrum** may need to be removed)

Please Note: It is important not to cut tubing or disconnect the pump from the tubing as the remaining insulin in the tube may infuse quickly risking hypoglycaemia.

- Label device, store it securely and document where the CSII is stored, or to whom it has been given.

- **S/C Insulin must be started immediately**
- i.e. within an hour to avoid risk of ketoacidosis.

- Consider download / storage of pump data

Re-starting insulin pump therapy

- Ideally **user to restart** CSII
- If CSII has been **only temporarily removed or suspended** and SC cannula still in position, patient should perform a "fixed prime" to refill the dead space within the tubing, then reconnect and restart basal infusion.
- **If capillary glucose >10mmol/l**, deliver a bolus a correction dose once CSII re-connected, using their pump settings
- **If transferring from IV insulin infusion**: insert new cannula and re-start CSII perform a fixed prime (there is no need to wait until a meal); **wait 60 minutes before discontinuing IV insulin.**
- If **transferring from subcutaneous insulin**: insert new cannula, perform a fixed prime and re-start CSII. (CSII settings may need to be reprogrammed). Consider need for **temporary reduction in background insulin infusion rate** (e.g. drop to a 70% temporary basal rate for 24hrs or use "ease off" features / temporary targets) while long acting subcutaneous insulin is still active

Re-check blood glucose 1-2 hours after CSII re-start.

Referral to diabetes team

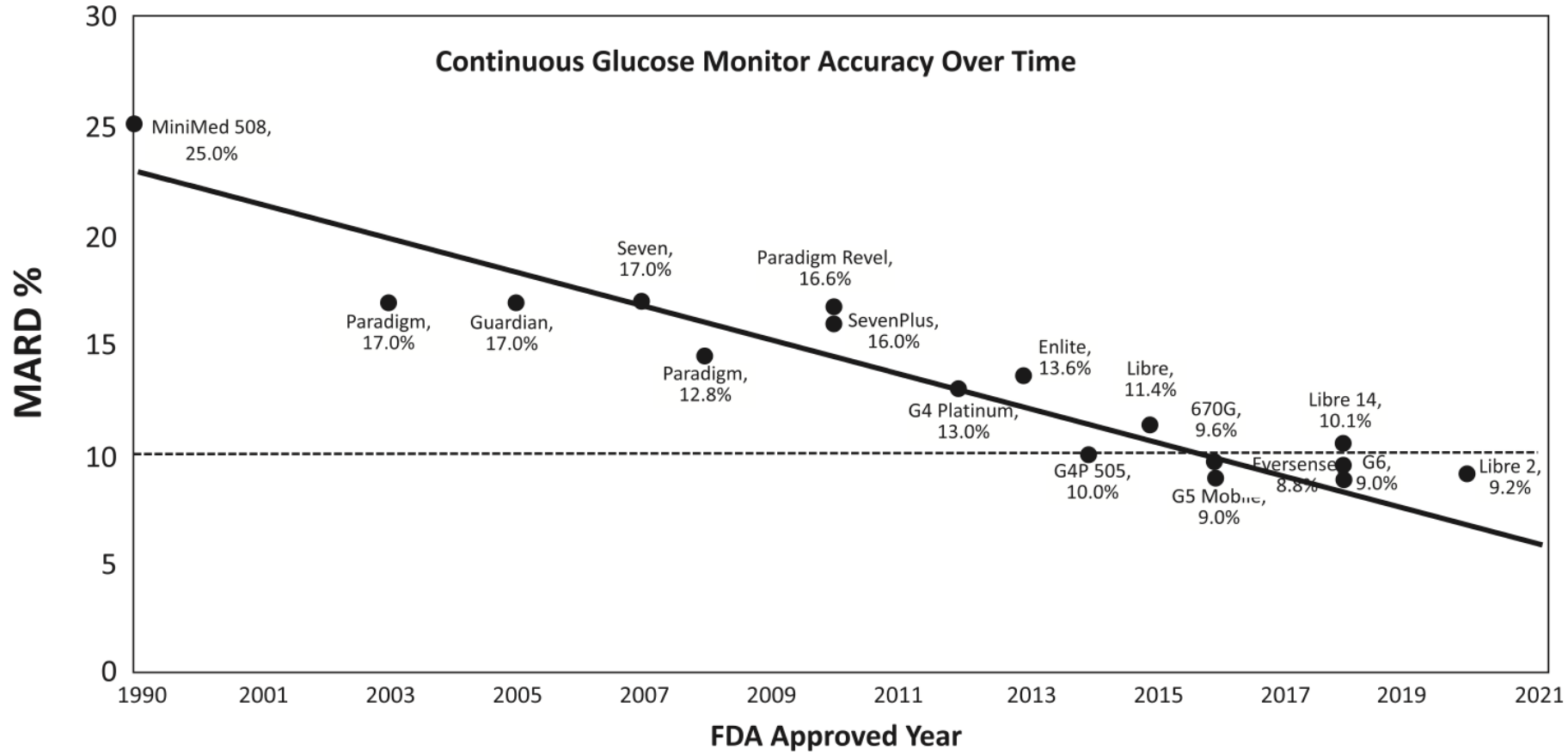
What about HCL use in hospital environments?

Considerations:

- Staff familiarity with the systems
- Individuals ability self manage (safely)
- Access to data
- Back up supplies and costs / access
- If well and visiting for an elective procedure / investigation – consider leaving HCL intact
- If unwell (changing hemodynamic / insulin requirements) – consider switch to manual mode (JBDS-IP) to allow adjustments in BG target/ Basal rates and ISF
- Impact of other medications – particularly Steroids
- Impact of nausea / vomiting / altered absorption / enteral feeding
- Surgery – planned / urgent / length of time / GA / sedation
- Support by in-patient (appropriately trained HCP's) – (limited services out of hours?)

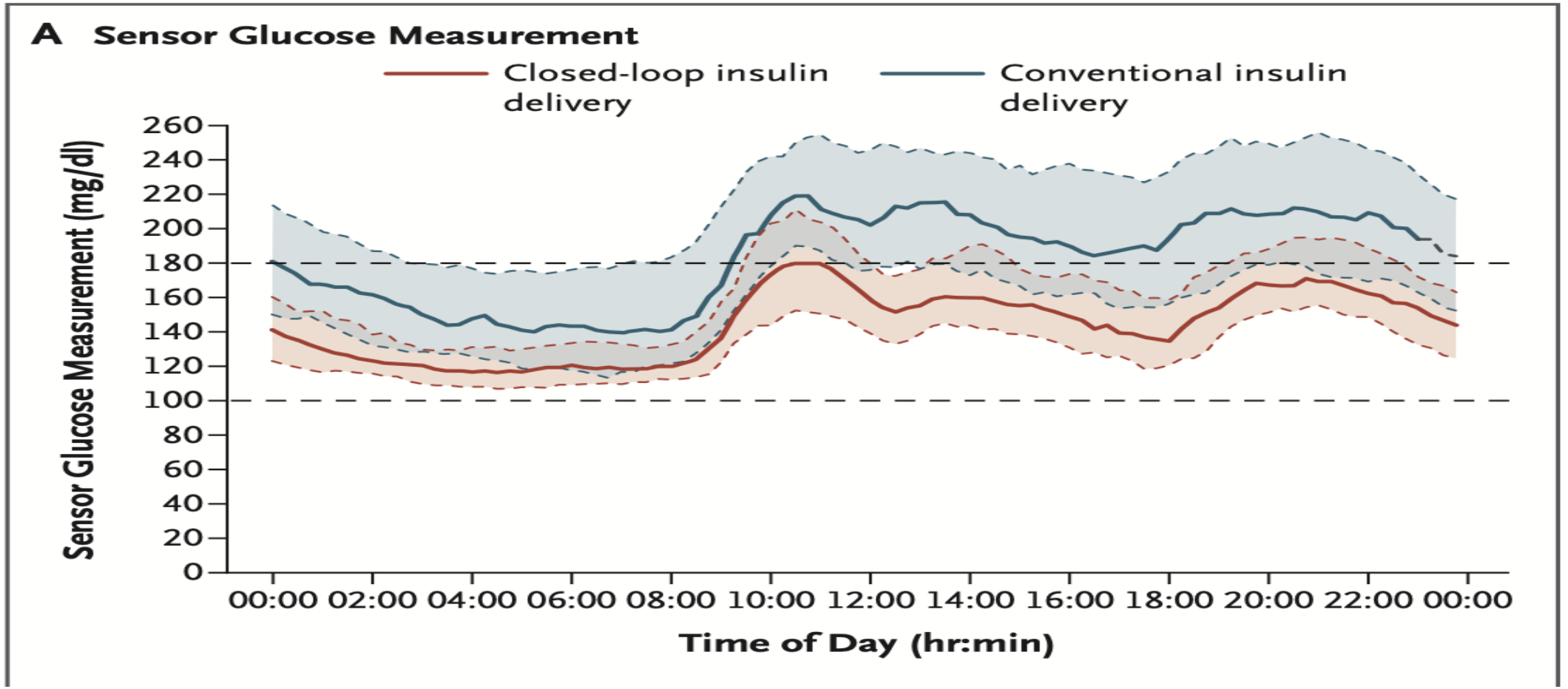
The Science……

Improved CGM technologies



Bailey T & Alva S (2021) https://doi.org/10.1089/dia.2021.0236

Closed loop therapies in noncritical care



Bailey et al (2018) https://www.nejm.org/doi/10.1056/NEJMoa1805233?url_ver=Z39.88-2003&rfr_id=ori:rid:crossref.org&rfr_dat=cr_pub%20%200www.ncbi.nlm.nih.gov

Summary

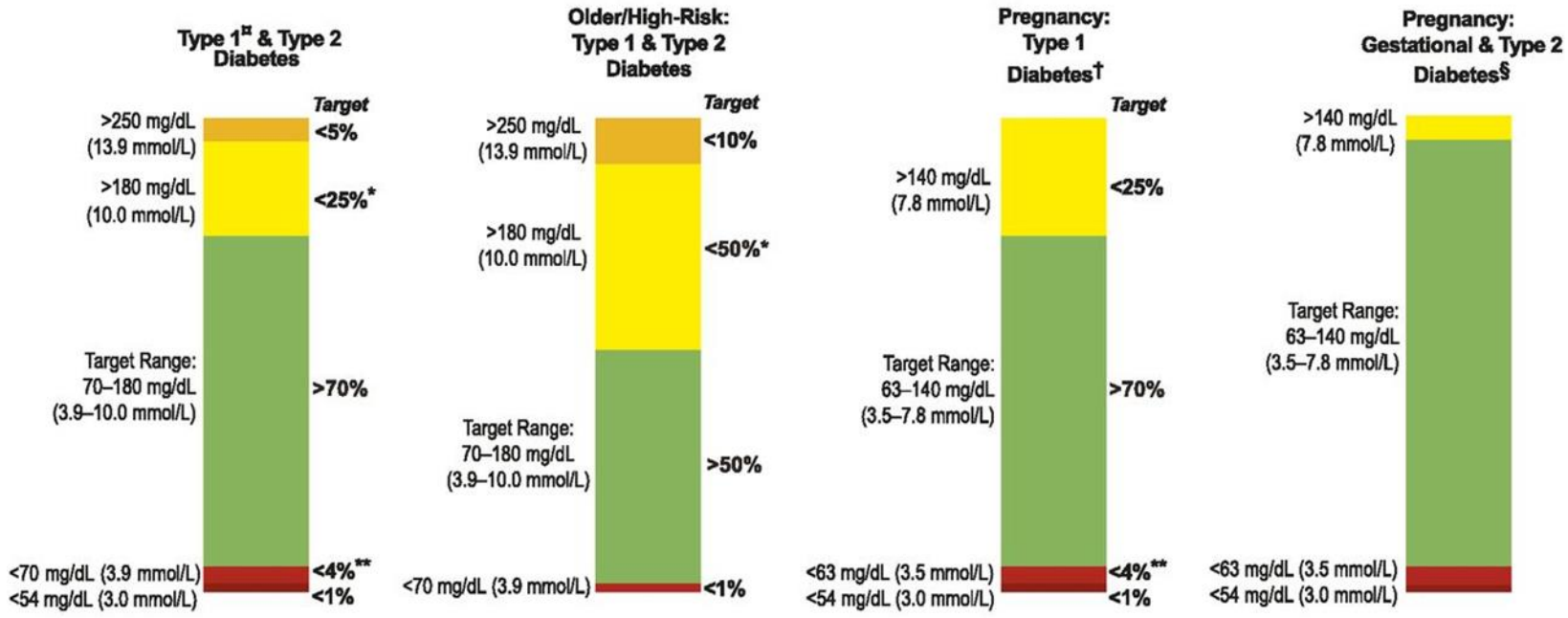

SUMMARY
BRIEF
FACTS
CONCISE
COMPENDIOUS
DESCRIPTIVE
COMPACT
RESUME
SHORT
REVIEW
LENGTH
DIGEST
BULLETIN
INFORMATION
ABRIDGMENT
EPITOME
EXTRACT
ESSENCE
IDEA

Best Practice (JBDS)

1. For any person with diabetes admitted to hospital, particularly T1D, check whether they use any wearable technology. If admitted unconscious, check for wearable diabetes technology (usually worn on the arm or abdomen, but may sometimes be on thighs/ buttocks.
2. If the person with diabetes can self-manage and capable of using their technology device, they should be encouraged to do so as they do out of hospital.
3. For CGM, whilst the person with diabetes is in hospital, ensure at least 2 capillary blood glucose are checked daily to ensure accuracy (given the impact of medical conditions)
4. Ensure the device (CGM/CSII) is not inserted into area of generalized oedema or cellulitis.
5. If the person is due for a procedure or operation where they will continue using their device, ensure it is on a different area of the body (contralateral side) so that it is not affected.
6. In hospital glycaemia targets using CGM:
    a. % time below range (<4mmol/L) aim <1%
    b. % time in range (4-10mmol/L) aim >50%
    c. % time above range (>4mmol/L) aim <50%
7. Diabetes in-patient teams should have a supply of sensors available to support people in hospital who rely on these for self-management.

Summary

- People with diabetes technology will end up in hospital
- Need to make emergency medicine colleagues aware of technology
- Use of technology (esp. CGM) in hospital can help glucose control in hospital and reduce hospital stay



References:

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Thanks for listening