Technoleg Iechyd Cymru
Health Technology Wales

HEALTH TECHNOLOGY WALES (HTW) GUIDANCE 012 (September 2019)

Continuous glucose monitoring in pregnant women with type 1 diabetes

HTW Guidance: The case for adopting continuous glucose monitoring in pregnant women with type 1 diabetes is supported by the evidence.

The use of continuous glucose monitoring during pregnancy improves glycaemic control and reduces the incidence of pre-eclampsia in the mother as compared to self-monitoring of blood glucose. Continuous glucose monitoring reduces neonatal hypoglycaemia and the need and duration of neonatal intensive care stay.

Cost modelling estimates that the use of continuous glucose monitoring in type 1 diabetic mothers will lead to cost savings of £1,029 per pregnancy as compared to self-monitoring of blood glucose, with the cost savings largely driven by a reduction in neonatal intensive care requirements.

Why did Health Technology Wales (HTW) issue this guidance?

Pregnant women with type 1 diabetes have a greater risk of miscarriage, pre-eclampsia and pre-term labour. Babies born to mothers with type 1 diabetes are more likely to be stillborn or to experience a wide range of medical problems after delivery. Tight control of maternal blood glucose levels during pregnancy is thought to minimise these risks to mother and baby. The standard and well-established method of checking blood glucose levels in pregnant women with type 1 diabetes involves the mother taking a drop of her blood from the finger-tip after a needle prick and testing it in a glucose meter several times per day. This is referred to as self-monitoring of blood glucose (SMBG). Continuous glucose monitoring (CGM) is an alternative means of measuring glucose levels in the tissues just below the skin. CGM uses a sensor that is placed on the upper arm and worn externally by the user, allowing blood glucose information to be monitored continuously. This information helps the user and their clinical team to identify what changes are needed to insulin administration to achieve optimal glucose control. SMBG is still used with CGM to guide changes to treatment but the frequency of testing is reduced and the timing guided by the CGM results.

The HTW Appraisal Panel concluded that the current evidence indicates that compared with SMBG, the use of CGM in mothers with type I diabetes improves control of blood glucose in pregnancy and that this results in an improvement in a number of important outcomes in the mother and baby. Furthermore, since the requirements for intensive care are reduced for babies after birth, it is estimated that the improved clinical outcomes will also lead to overall cost savings.

This topic was notified to HTW by Dr Julia Platts, Consultant in Diabetes, Cardiff and Vale UHB and National Clinical Lead for Diabetes in Wales.

The status of HTW guidance is that NHS Wales should adopt this guidance or justify why it has not been followed. HTW will evaluate the impact of its guidance.

Summary of the evidence

For a detailed analysis of the evidence, refer to the accompanying Evidence Appraisal Report.

There is published evidence from 4 randomised clinical trials that compared the clinical effectiveness of CGM (used as an adjunct to SMBG) to SMBG alone in pregnant women with type 1 diabetes. All of the studies used CGM systems manufactured by Medtronic, but in the older trials the systems used have now been superseded by newer iterations and may not, therefore, be entirely representative of current clinical practice.

The evidence suggests that the use of CGM leads to a significant improvement in maternal glycaemic control, as measured by glycosylated haemoglobin levels, and a reduction in the incidence of pre-eclampsia. In the neonate, the use of CGM is associated with a significant reduction in hypoglycaemia, and incidence or duration of ICU admission. The evidence leaves uncertainty as to whether CGM positively influences other outcomes, such as the need for caesarean section and the incidence of pregnancy-induced hypertension, miscarriage, increased birthweight and neonatal mortality/stillbirth.

Very limited evidence exists to compare CGM to flash glucose monitoring in pregnant women with type 1 diabetes, and the relative effectiveness of these two interventions in this population is therefore uncertain.

One economic study was identified that analysed the overall costs associated with the use of CGM compared to standard management in pregnant women with type 1 diabetes. Cost modelling was undertaken to estimate the overall resource impact of CGM, used as an adjunct to SMBG, compared to SMBG alone on the basis of the results of this study and in the context of clinical practice in NHS Wales. The results showed that CGM is likely to lead to overall costs savings of approximately £1,029 per pregnancy, with the cost savings largely driven by a reduction in the incidence and duration of neonatal ICU admission.

Appraisal Panel considerations

- The Appraisal Panel considered that the published evidence for the use of CGM in pregnancy in type 1 diabetic mothers is of good quality although the total number of patients studied in the 4 RCTs is relatively small. The Panel noted that one RCT included only patients with Type 1 diabetes (Feig et al. 2017) while the remaining 3 RCTs included patients with both Type 1 and Type II diabetes. The Appraisal Panel considered that the analysis of all patients with Type I diabetes across the 4 RCTs was appropriate and that the results indicated significant and beneficial outcomes through the use of CGM in the mother and baby as compared with standard SMBG.
- The Appraisal Panel concluded that it is plausible that the documented improvements in glycaemic control during pregnancy achieved through the use of CGM are likely to lead to the observed improvements in clinical outcomes as compared with standard SMBG. The Panel noted a significant reduction in the incidence of pre-eclampsia in the mother as well as a significant reduction in hypoglycaemia in the neonate through the use of CGM. The Panel noted that reductions were not seen in other important clinical outcomes (such as the need for caesarean section, the incidence of pregnancy-induced hypertension, miscarriage, increased birthweight and neonatal mortality/stillbirth) but concluded that this may be related to the relatively small and possibly under-powered clinical trials reporting these outcomes.
- The Appraisal Panel heard from the clinical expert that standard care in NHS Wales in regard to the monitoring of blood glucose in pregnancy in mothers with Type I diabetes involves the use of SMBG. The expert explained that flash glucose monitoring has been introduced for some

patients but that this practice is relatively limited in Wales. The committee noted that there is very little published evidence currently available that compares the use of CGM with flash glucose monitoring: the single study available was a retrospective observational study that showed no significant difference in any clinical outcomes in mother or baby between these two different methods. The committee would welcome the results of future research into a comparison of CGM with other emerging technologies for monitoring of blood glucose in pregnancy and would encourage robust prospective and randomised clinical trials be undertaken.

- The Appraisal Panel were informed by the expert that the device manufacturers provide training for patients and Diabetes Nurse Specialists in the use of CGM. It was explained that direct and regular contact with patients is maintained throughout pregnancy and that this support ensures that the results of CGM are used appropriately in governing changes to insulin treatment.
- The Appraisal Panel noted that all of the four randomised trials comparing CGM as an adjunct to SMBG to SMBG alone used CGM systems from a single manufacturer (Medtronic Guardian REAL-Time, MiniMed Minilink, iPro2 or CGMS Gold). It was also noted that a single observational trial that compared clinical outcomes with flash glucose monitoring and CGM used the Dexcom G4 CGM device.
- The Appraisal Panel noted that in some of the trials, compliance with the CGM study protocol was reported as low. The HTW Lead Researcher explained to the committee that this reduced compliance was not necessarily as a result of patients' dissatisfaction with the device itself but may rather have been a reflection of the way in which CGM was used in the studies. It was noted that the CGM protocol varied between the studies with its use in some restricted to intermittent use at intervals throughout pregnancy. The Panel noted, however, that in the most influential of the RCTs (Feig et al. 2017), CGM was used daily throughout pregnancy. It was concluded that the variation in compliance with CGM between the studies is likely to mostly reflect variable levels of patient engagement with sometimes complex monitoring protocols as opposed to patient dissatisfaction with the CGM device itself. The expert confirmed that in her experience, the devices were used in some of these trials in a manner that was not representative of current practice and that patient discomfort and inconvenience with CGM is comparable or less than with other blood glucose monitoring methods.
- The Appraisal Panel noted the results of the cost modelling that indicated overall costs savings through the use of CGM during pregnancy in type 1 diabetes. The Panel heard from the HTW Health Economist that modelled cost savings are driven primarily by a reduction in the use of neonatal intensive care in pregnancies and that sensitivity analyses indicate that CGM remains cost saving across a range of scenarios. The Panel noted that the cost savings in the model had been estimated on the basis of ITU/HTU utilization practice in NHS Wales, itself informed by independent expert advice. The expert attending the meeting confirmed that this model of care seemed appropriate.
- The HTW Health Economist reported that an estimated 206 women per year in Wales would be eligible to use CGM. Based on 100% adoption, the total cost saving of introducing CGM is estimated at £211,998 per year. The Appraisal Panel noted, however, that there is some uncertainty around the exact number of women eligible to use CGM, and that 100% uptake is unlikely to be realised. On the other hand, the Appraisal Panel noted that the economic model does not take into account wider potential benefits such as the financial and emotional impact on families through reducing the need and length of ITU stay. The Appraisal Panel concluded that in this regard, the estimates of cost savings are likely to be conservative.

Responsibilities for consideration of this Guidance

Health Technology Wales (HTW) was established by Ministerial recommendation[1,2] to support a strategic, national approach to the identification, appraisal and adoption of non-medicine health technologies into health and care settings. The HTW Appraisal Panel comprises senior representation from all Welsh boards with delegated authority to produce guidance 'from NHS Wales, for NHS Wales'. The status of HTW guidance is 'adopt or justify'. There is an expectation from Welsh Government that HTW guidance is implemented with adoption regularly audited by HTW.[3]

The guidance in this document is intended to assist Welsh care system decision makers to make evidence-informed decisions when determining the place of health technologies and thereby improve the quality of care services.

The content of this HTW guidance was based upon the evidence and factors available at the time of publication. An international evidence base was reviewed and external topic experts and HTW committee members consulted to contextualise available evidence to Wales. Readers are asked to consider the generalisability of the evidence reviewed to NHS Wales and that new trials and technologies may have emerged since first publication and the evidence presented may no longer be current. It is acknowledged that evidence constitutes only one of the sources needed for decision making and planning.

This guidance does not override the individual responsibility of health professionals to make decisions in the exercise of their clinical judgment in the circumstances of the individual patient, in consultation with the patient and/or guardian or carer.

No part of this guidance may be used without the whole of the guidance being quoted in full. This guidance represents the view of HTW at the date noted. HTW guidance is not routinely updated. It may, however, be considered for review if requested by stakeholders, based upon the availability of new published evidence which is likely to materially change the guidance given.

Standard operating procedures outlining HTWs evidence review methods and framework for producing its guidance are available from the HTW website.

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Declarations of interest were sought from all reviewers. All contributions from reviewers were considered by HTWs Assessment Group. However, reviewers had no role in authorship or editorial control and the views expressed are those of Health Technology Wales.

Chair, Health Technology Wales Appraisal Panel

1. National Assembly for Wales, Health and Social Care Committee. Access to medical technologies in Wales. December 2014.
2. Response to Recommendations from the Health & Social Care Committee: Inquiry into Access to Medical Technologies in Wales. February 2015.
3. Gething, V. Letter to all Health Board Chairs re Funding for Sacral Nerve Stimulation in Wales. VG_01655_17. September 2017.