The utility of continuous glucose monitoring systems in the management of children with persistent hypoglycaemia

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Background

- Hypoglycaemia in children can have adverse neuro-developmental outcomes. Hence, it is vital to monitor glucose levels[1].
- 25-50% of children with persistent hypoglycaemia secondary to hyperinsulinism display permanent cognitive deficits, speech delay and motor delay[1].
- Traditionally, finger pricks were used to monitor the blood glucose levels. However, these are invasive and provide limited glucose values.
- In Australia and world-wide, only few centres use continuous glucose monitors (CGM) to monitor glucose levels in children with hypoglycaemia. Evidence of using CGM in children with hypoglycaemia is limited with small sample sizes (N=11 & 15)[2,3].
- Hence it is important to address the role of CGM in monitoring of children with persistent hypoglycaemia.

Aims

- To determine the accuracy, sensitivity and specificity of CGM in children with hypoglycaemia.
- To evaluate the parental experience of using CGM to monitor glucose levels.

Inclusion Criteria

➢ Children with hypoglycaemia who were on CGM and
➢ Attended Endocrinology clinic at Perth Children's Hospital 2014-2019

Study 1: Retrospective analysis of glucose data
➢ 173 CGM downloads provided a total of 5,650 paired sensor glucose (SG) and blood glucose (BG) values
➢ Paired SG and BG values were converted to CSV file and analysed
➢ The accuracy of CGM was analysed with Bland-Altman method
➢ The sensitivity and specificity of CGM to detect hypoglycaemia were calculated

Study 2
➢ Parent questionnaire (8 questions) was designed and administered using a secure online platform.

Parameters of Glucose

➢ Normal ≥ 3.5 to ≤ 7.8mmol/l
➢ Hypoglycaemia <3.5mmol/l

Results

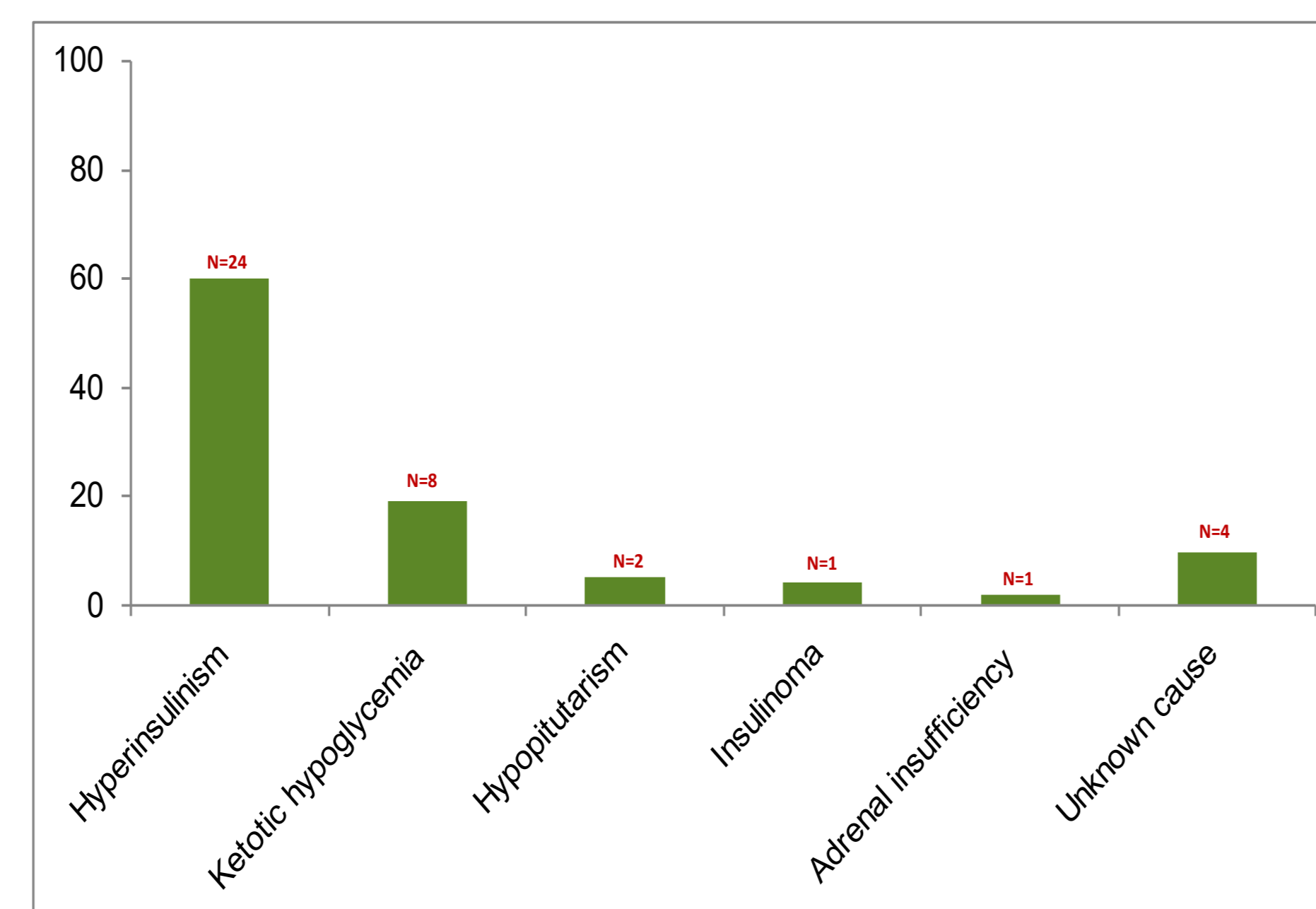### Figure 1: Hypoglycaemia: Cohort

Figure 2: Accuracy Between BG and SG
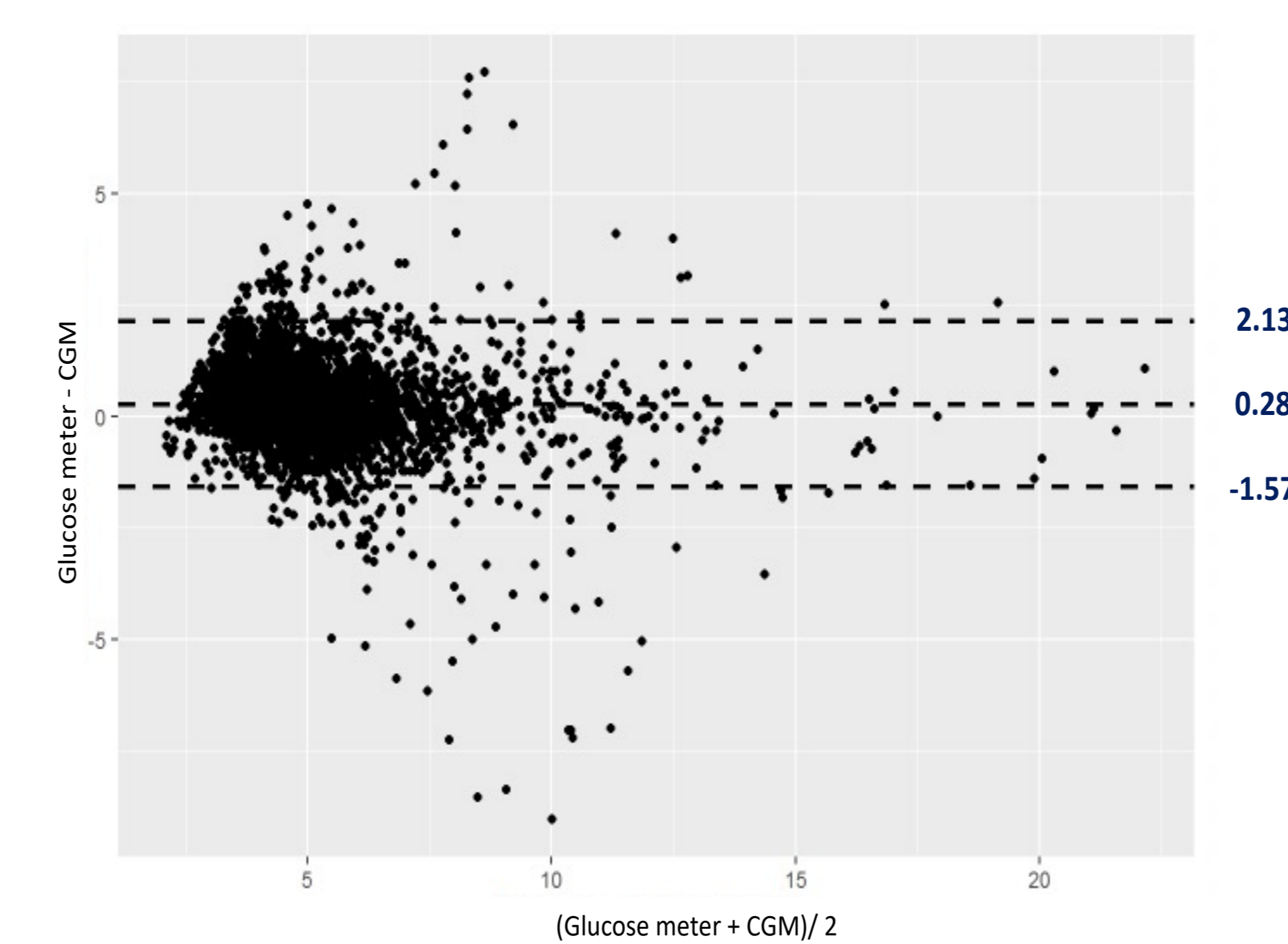
Table 1: Ability of CGM to Detect Hypoglycaemia

Parameter	Sensitivity %	Specificity %	PPV %	NPV %
Hypoglycaemia (< 3.5)	78.2 (72.8, 82.9)	89.2 (88.3, 90.1)	31.3 (27.8, 34.9)	98.5 (98.1, 98.8)
Parameter	Sensitivity %	Specificity %	PPV %	NPV %
Severe hypoglycaemia (< 3.0)	54.3 (39.0, 69.1)	97.4 (96.9, 97.8)	16.0 (10.6, 22.7)	99.6 (99.3, 99.7)

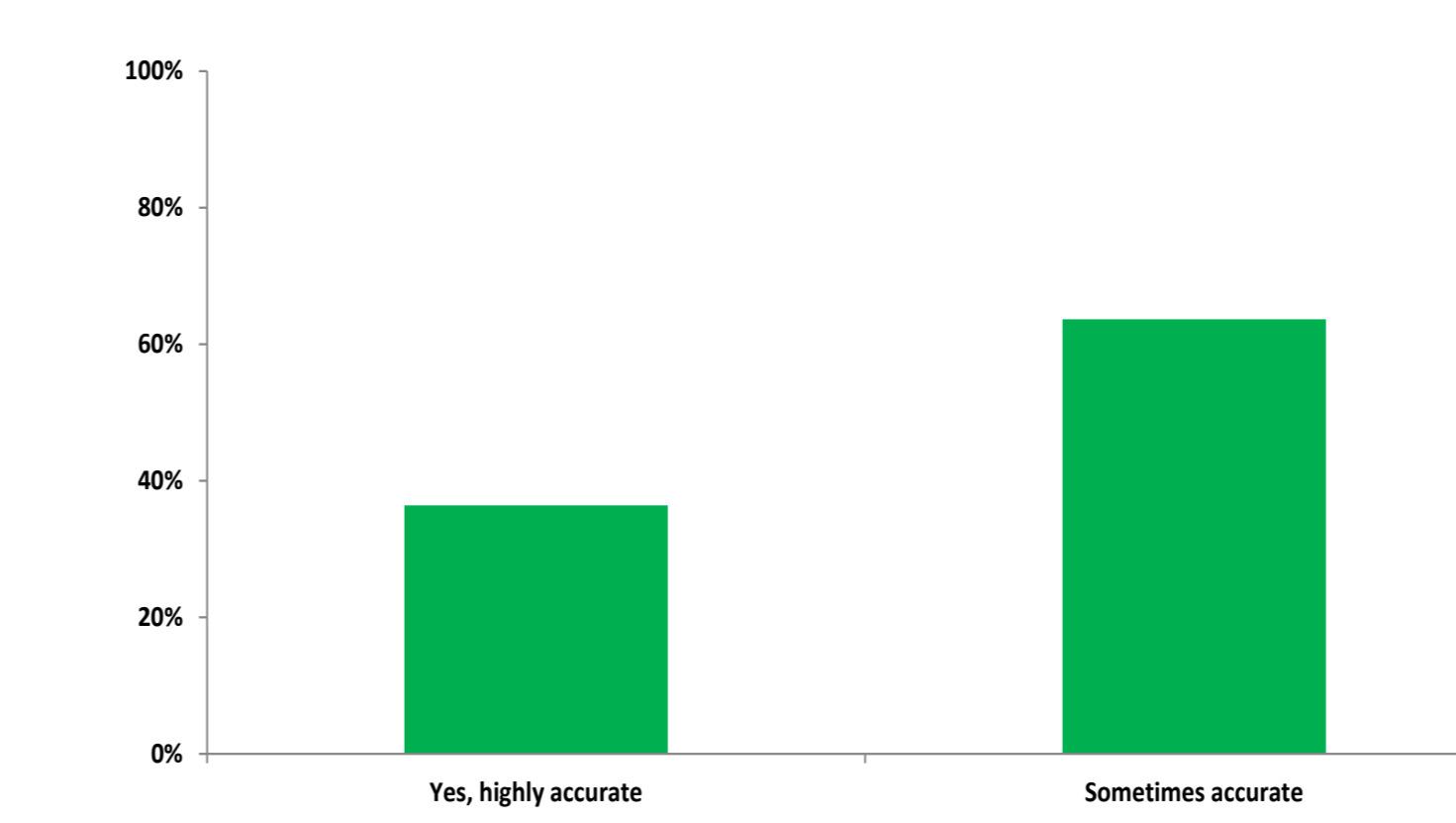### Figure 3: Parent Questionnaire

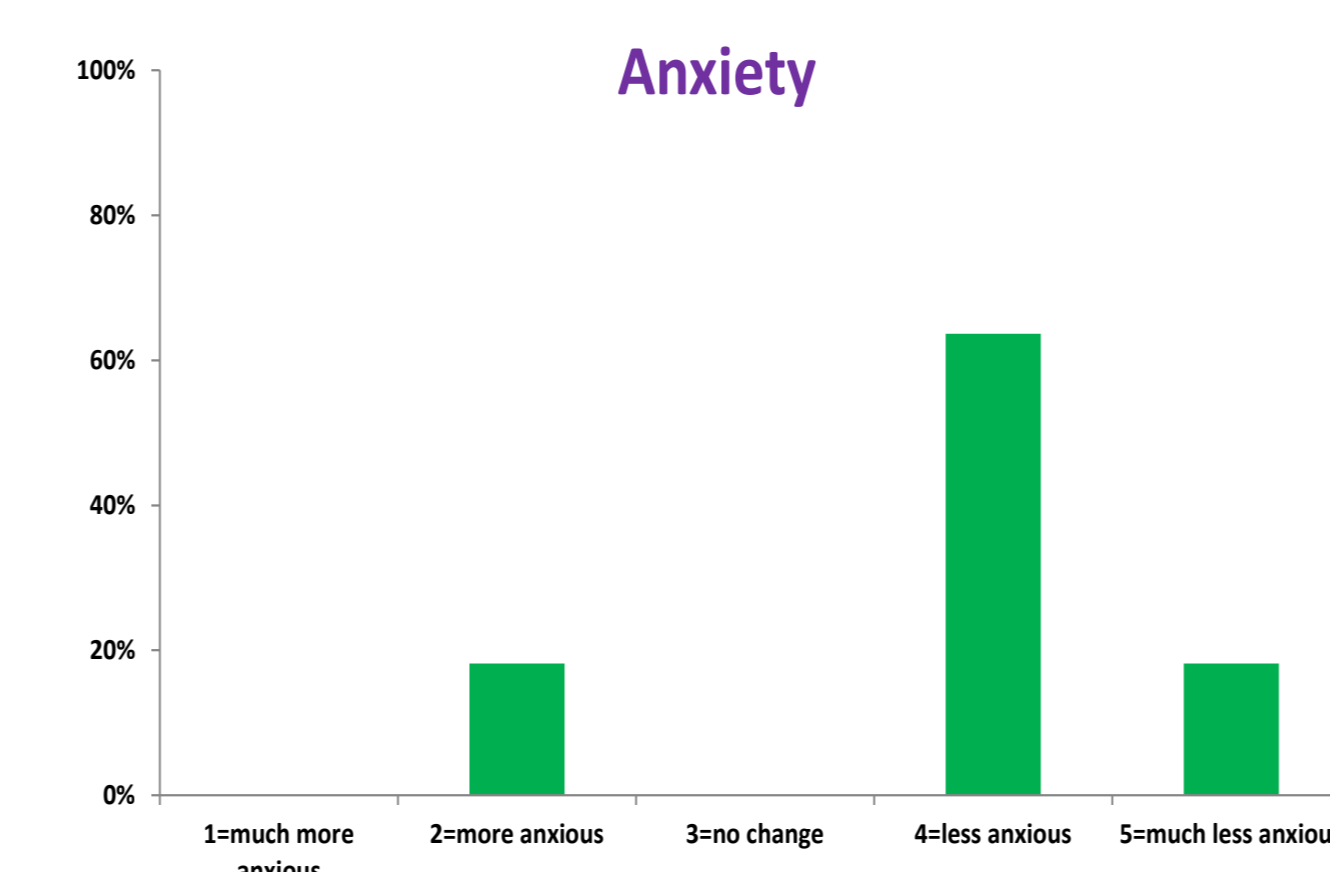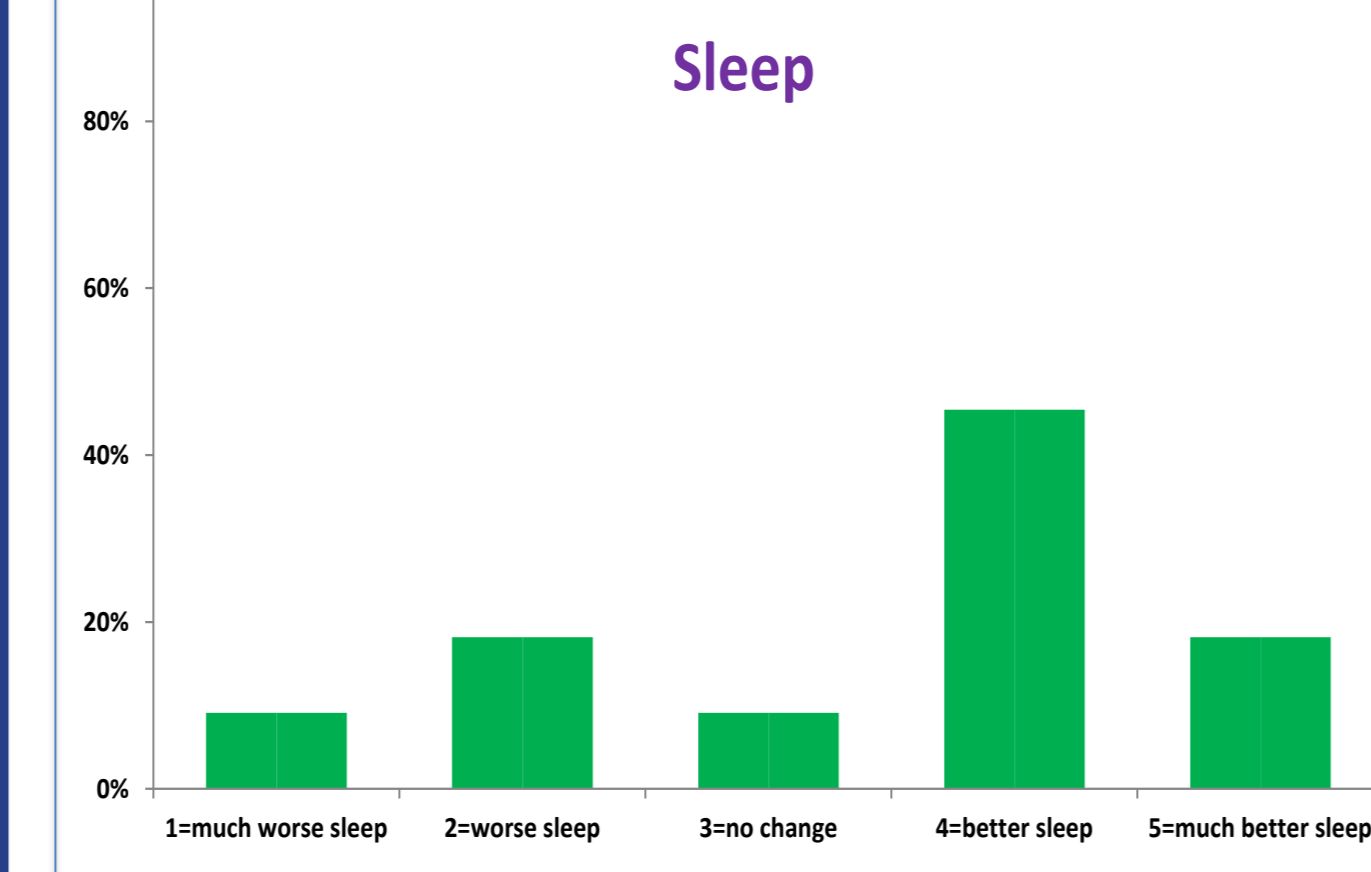**What type of glucose monitoring would you prefer your child to have?**
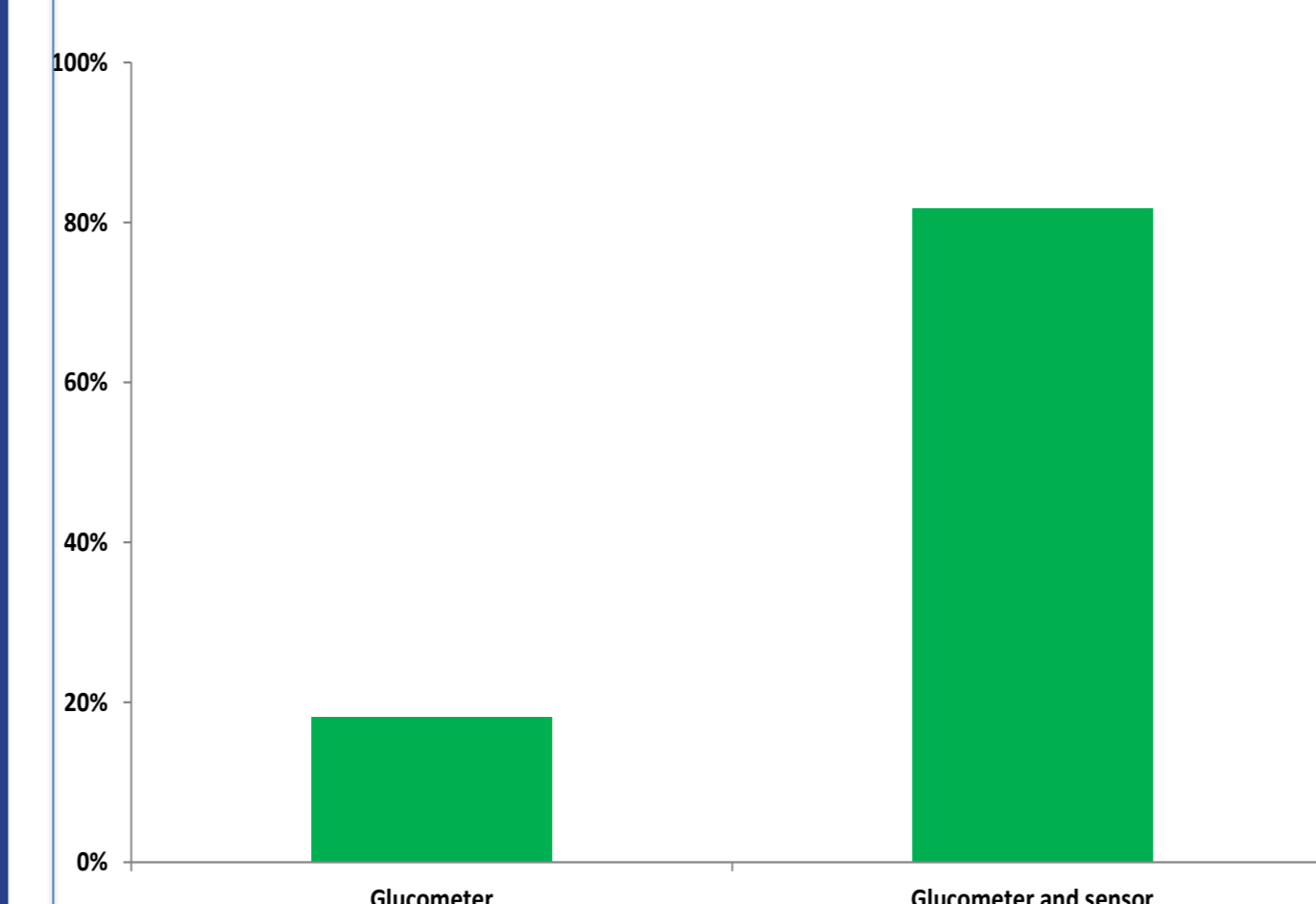
Were you confident in using the sensor to monitor your child's glucose levels after the education was provided?
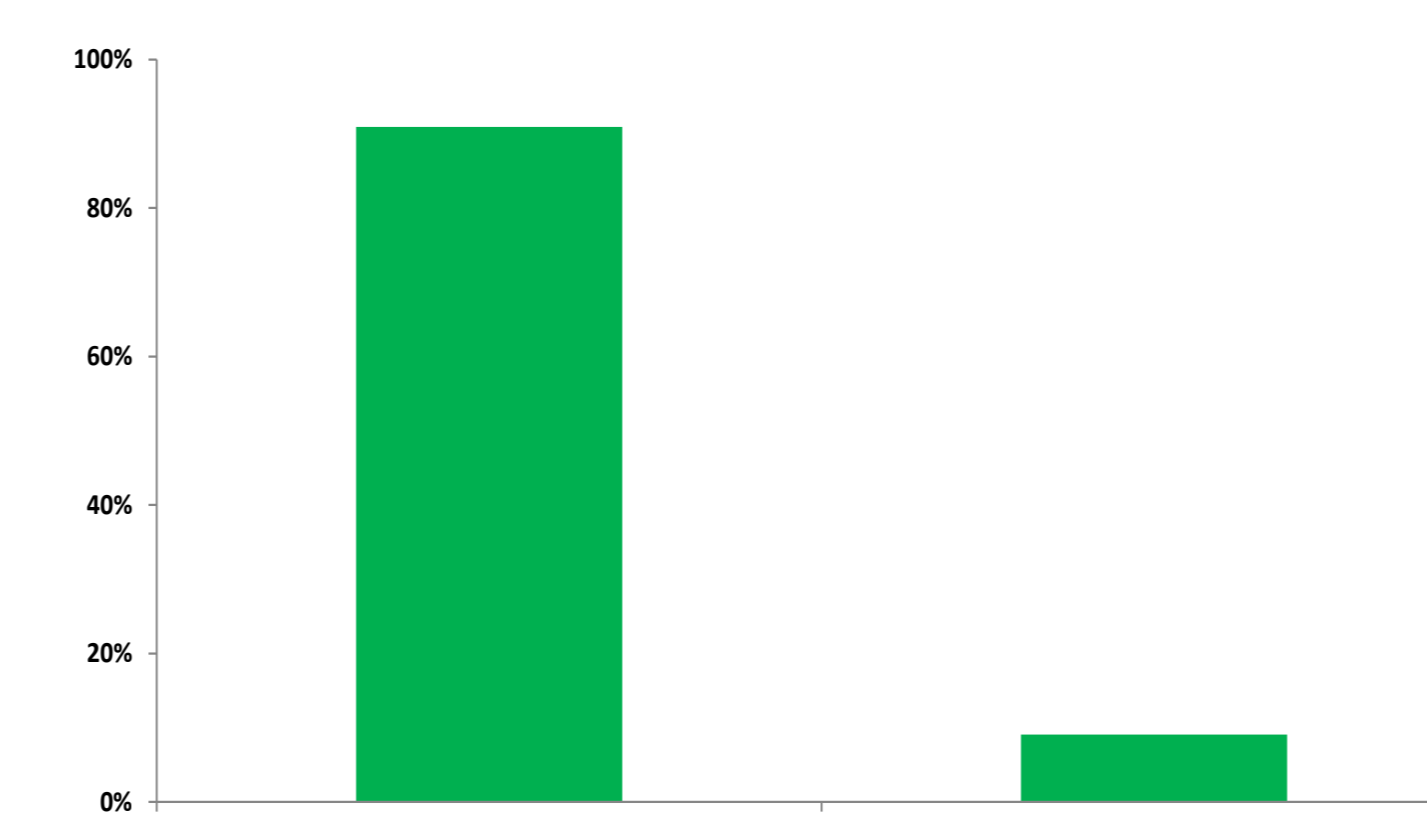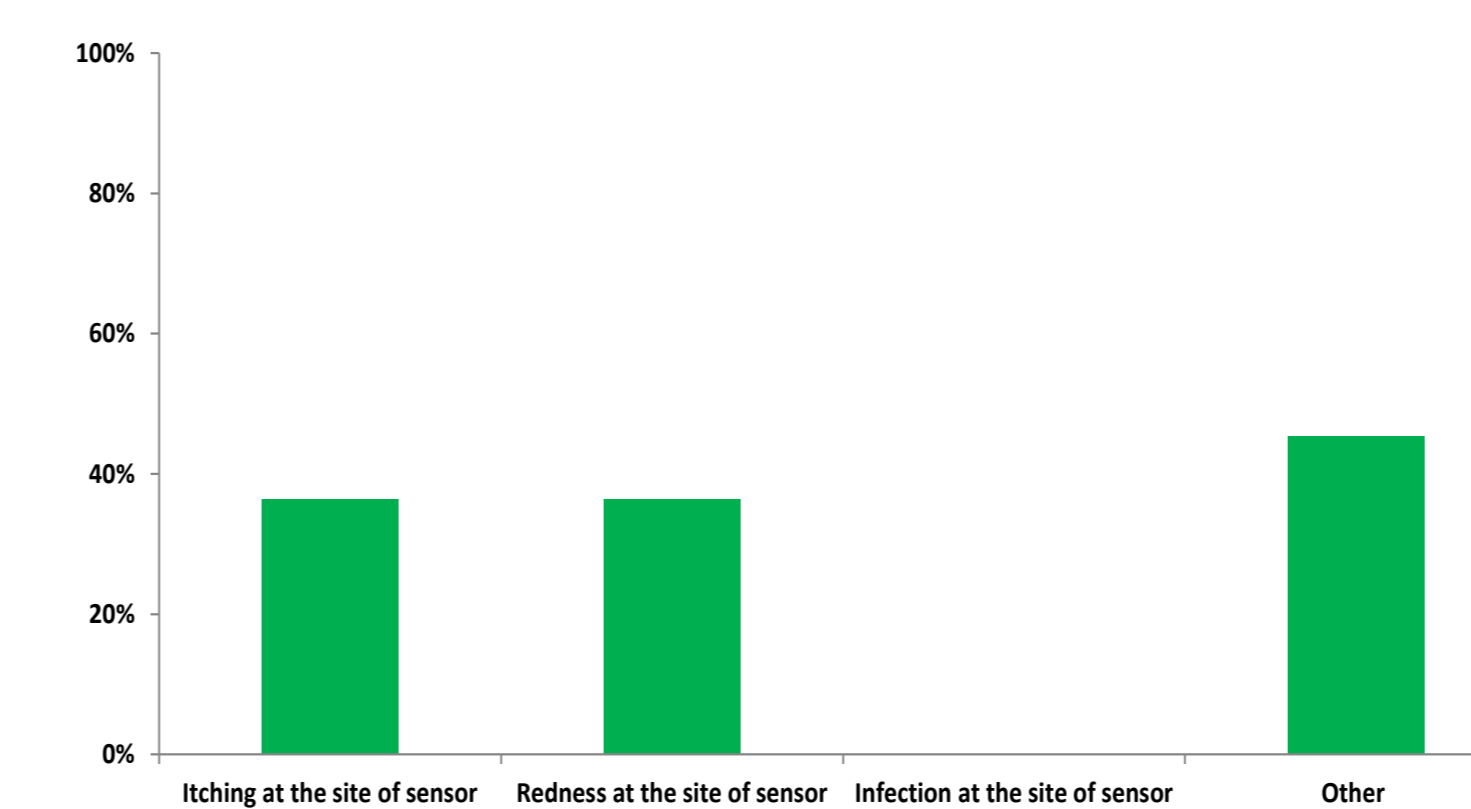

Was the sensor accurate in monitoring your child's glucose levels?

How much has the quality of your (carer's) sleep and anxiety changed since Starting the sensor?

What complications did your child experience with the insertion of the sensor?

- 60% (N=40) of the children had hyperinsulinism. The median age of this cohort was 6 months (Fig1).

- The mean variation or difference between BG and SG was 0.28 mmol/L and the lower and higher limits of agreement were -1.57 to 2.13, representing the 95% confidence interval (Fig 2).

- The high negative predictive value of CGM provides reassurance for parents when CGM is not alarming and prevents unnecessary BG checks during times of normoglycaemia (Table 1).

- All low SG values should be followed up by a confirmatory BG due to high false positive rate (Table 1).

- Parents reported lesser anxiety, better sleep at night and preferred to use CGM for monitoring glucose levels in their children (Fig 3).

Conclusion

Despite the limitations of CGM in monitoring hypoglycaemia, it remains a valuable tool in the management of children with persistent hypoglycaemia.

References

1. *Menni et al, Paediatrics, 2001*
2. *Rayannavar et al, Hormone Res Paediatrics; 2019*
3. *Alsaffar et al, International Journal of Paediatric Endocrinology; 2018*

Acknowledgements