

**The Rowan Hillson Insulin Safety Award 2015
Best UK Inpatient Hypoglycaemia Prevention Initiative**

How to enter:

1. Email your completed entry to: Christine Jones, JBDS Administrator at christine.jones@nnuh.nhs.uk

All entries must be emailed by 1st September 2015

2. Please submit any supplementary materials to support your initiative, as these will be considered as part of the judging process.
3. **Please note this competition is only for projects undertaken in the last 3 years i.e. since 1.1.2012.**

Your contact details:

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Post: Consultant Physician/Diabetologist

Trust name and address where work was undertaken: Ipswich Hospital NHS Trust

Additional contributors: Dr R Rajendran, C Kelly, R Round, S Barker, A Scott and the Diabetes Inpatient Care and Education (DICE) Team

Title of entry (10 words maximum)

Innovative use of ward glucose systems to reduce inpatient hypoglycaemia

Brief summary of entry

Provide a short summary of your initiative in **no more than 200 words (The box will expand)**

Hypoglycaemia is a distressing and potentially fatal consequence of poor glycaemic management of inpatients diabetes. Within our trust we have introduced a number of education initiatives and care pathways to prevent hypoglycaemia. These form part of our Diabetes Inpatient Care and Education (DICE) project which aims to reduce harms to inpatients with diabetes. As part of this initiative we have adapted the Abbott Precision Xceed Pro™ monitoring system to audit the impact of our project, and also to form an alert system for out of range capillary blood glucose results, in particular hypoglycaemic readings, so that these can be readily addressed by the Diabetes Inpatient Team. We have also used this system to look for potentially preventable temporal patterns of dysglycaemia and found overnight hypoglycaemia to be a particular issue as well as a high frequency of pre breakfast sulphonylurea related hypoglycaemia. This has led us to provide a prescribed bedtime snack

as well as to proactively address admission medication.

These combined initiatives and innovations have resulted in a 46% reduction in severe hypoglycaemia and a 68% reduction in the need for IV glucose rescue treatment.

Background/Situation analysis/Innovation (300 words maximum)

Briefly provide the background and rationale for the initiative. From this the judges should be able to understand why there was a need for the initiative to be undertaken. Explain what makes your initiative innovative or pioneering.

The National Diabetes Inpatient Audit (NaDIA) found that approximately one in five people with diabetes in hospital experiences a hypoglycaemic blood glucose result (<4.0mmol/l) and approximately one in ten a 'severe' hypoglycaemic result (<3.0mmol/l). Since the first NaDIA there has been a significant increase in awareness of this harm resulting in a number of initiatives to reduce hypoglycaemia, including e-learning modules, the 'think glucose' programme, inclusion of diabetes education in junior doctor induction programmes, redesign of insulin/glucose charts etc. Despite these initiatives, although NaDIA has shown year on year reductions in hypoglycaemic events these have been disappointingly small. For example all hypoglycaemic episodes fell from 22.8% to only 20% which though statistically significant still leaves an unacceptable number of people experiencing this unpleasant and potentially preventable harm. Furthermore, life threatening hypoglycaemia i.e. that requiring IV glucose or glucagon rescue treatment remained unchanged (approximately 220 events in the week of NaDIA equivalent to 11,500 events per year).

We, like others have been proactive in promoting hypoglycaemia prevention through multiple means including utilising our 'diabetes link nurses' to cascade best practice, encouraging uptake of the Virtual College e-learning modules, running induction programmes for new medical staff, introducing a care pathway [the Diabetes Care and Education (DICE) chart] and redesigning our insulin/glucose charts. However, in practice we found that the impact of 'link nurses' to be variable and uptake of e-learning poor. The DICE care pathway and junior doctor induction programme though achieving very good engagement and reducing prescription errors by >80% did not result in staff being sufficiently proactive in preventing hypoglycaemia particularly recurrent hypoglycaemia.

These observations supported our development of an innovative approach in which point-of-care (POC) capillary blood glucose (CBG) data routinely provided from each ward to the chemical pathology laboratory for quality control could be configured for clinical use and particularly for preventing hypoglycaemia.

Objectives (200 words maximum)

State clearly the objectives of the initiative(s).

The objectives were-

- 1) To develop a means of linking CBG data extracted from the Abbott Precision Xceed Pro™ Web POC meters (Abbott Diabetes Care Inc., Alameda, CA, USA) to patients unique identifiers, ward location and date and time for analysis
- 2) To utilise this system to determine whether temporal trends in glycaemia exist which may relate to potentially correctable institutional practices
- 3) To work with other hospital trusts employing the same CBG system to learn from each other
- 4) To develop an alert system based on daily CBG meter downloads containing patient identifiable data including ward placement to enable the DISNs to quickly and timely target patients with 'out of range' results, in particular hypoglycaemia.
- 5) To use CBG data for audit of the impact of the DICE programme on hypoglycaemia

- and other glucometrics
- 6) The ultimate objective is to reduce inpatient hypoglycaemia

Project plan/methods (400 words maximum)

Please outline the method(s) you used to achieve your objectives. The judges will also be looking for a clear rationale for your method(s).

1. *Adapting the Abbott system for clinical use*

The Precision Xceed Pro™ monitoring system has been employed in our Trust since 2012. For the purpose of quality control the original system had a built in ethernet link to a centralised computer to enable the chemical pathology laboratory assess the performance of individual ward instruments as well as that of individual operators.

Despite being available globally for some years this link has not been previously used for clinical care although in the USA pathology departments have used it to analyse CBG data from large numbers of hospitals belonging to the same provider group to report a small but not particularly impressive improvements in mean CBG.

We brought together our IT department and Abbott Diabetes Care UK data management staff to work with us to provide a system that would allow extraction of the data in such a way that it could be clinically useful. Additionally, this collaboration allowed us to update from an ethernet linked system to a wi-fi linked web based system allowing the DISNs to have more rapid access to all CBG results rather than having to wait for the meters to be docked to the ethernet linked base transponder.

2. *Utilising the Abbott system to examine for temporal trends that may reveal potentially correctable institutional practices*

Study 1

Having anecdotally observed an increased frequency of overnight hypoglycaemia, we utilised the Precision Xceed Pro™ data to examine >15,000 CBG tests in September and October 2012 at Ipswich Hospital which confirmed that 70% of all hypoglycaemic events occurred between 21.00 and 09.00 h.

Study 2

Following the above, we initiated the Managing Glycaemia using Innovations in Care (MAGIC) study, a 4-week retrospective multicentre audit, in June 2013 in 11 NHS Trusts using the Precision Xceed Pro to determine whether this temporal pattern was isolated to our trust or was more widespread and if so to find common factors which could explain this observation (for the outcome and results see below).

3. *Implementing an alert system based on daily CBG meter downloads*

The DISNs put into practice a daily log in to download data on out of target CBG results (<4 mmol/l and >15mmol/l) enabling them to prioritise review of these patients each morning.

4. *Using the CBG data to assess the impact of the DICE programme*

The data from the system allowed us to derive 'glucometric' data over defined periods to assess the impact of the DICE programme.

Evaluation and results (400 words maximum)

Use this section to report the results and demonstrate how you measured the success of your initiative/project

Adapting the Abbott Precision Web system for clinical purposes

We successfully achieved the objective of devising a method of electronically extracting all identifiable CBG data for clinical use. The success of the collaboration between the Ipswich Hospital IT department and Abbott Diabetes Care is evidenced by further collaboration in a new project to deliver a dashboard of 'glucometrics' for each ward on a monthly basis.

Evaluation and results from Study 1 and Study 2

Diabet Med. 2013 Dec;30(12):1403-6. doi: 10.1111/dme.12256.

BMJ Open. 2014 Jul 9;4(7):e005165. doi: 10.1136/bmjopen-2014-005165

As previously described Study 1 demonstrated an excess of hypoglycaemia between 21:00 and 08:59. Looking for possible reasons we discovered that to limit catering costs patients are fed a light meal 5.30pm and do not eat again until 8-8.30am.

Study 2 confirmed the same temporal pattern of hypoglycaemia in all 11 Trusts, 68% occurring 'overnight'. This study also revealed that sulphonylurea (SU) treatment accounted for 32% of hypoglycaemic readings, furthermore hypoglycaemic readings were twice as frequent between 05:00 and 07.59 in SU treated patients than in insulin treated patients. Of importance the same catering practice was employed in all these trust. The one trust with the lowest hypoglycaemic rates provided a bedtime snack.

In response to these findings we have instituted a bedtime snack for all insulin and SU treated patients and have made this a prescription item (sticker on drug chart) to ensure that it is offered. Our DISNs are also proactive in reducing basal insulin and SU therapy in patients on admission whom they suspect may be at increased risk (eg reduced appetite, previous low HbA1c).

The impact of the DICE programme on hypoglycaemia and other glucometrics

We used the POC downloads to assess the effectiveness of the whole DICE programme on glycaemia. It is not possible to assess the impact of the Abbott Precision Web system independently.

The assessment compared glucose results is a six month period prior to the DICE interventions and the same calendar months in the following year. The results are shown in the table. In summary, severe hypoglycaemia results (<2.2 mmol/l) fell by 46%. The small increase in average CBG is clinically insignificant. Furthermore, recurrent hypoglycaemia reduced by 80% which we believe is due to early intervention by the DISNs triggered by the alert system. Importantly, the use on IV glucose rescue treatment fell from 0.68% (82 to 26 cases, p<0.001).

Length of stay, reflecting the multiple interventions, reduced from 8.6 to 7.6 days (p<0.01), whereas it remained unchanged in the non-diabetic population.

	Before intervention Jan to June 13	After intervention Jan to June 14	Significance	Relative Risk	Relative Risk Reduction
No. of inpatients	1723	1730			
No. of CBG tests	46976	37698			
Hypo ≤3.9 (No. and %)	2529 (5.38%)	1543 (4.09%)	p=0.0001	0.76	0.24
Hypo ≤2.9	933 (1.99%)	491 (1.3%)	p=0.0001	0.66	0.34
Hypo ≤2.2	348 (0.74%)	151 (0.4%)	p=0.0001	0.54	0.46
Acceptable 4.0-12.0	31293 (66.6%)	25143 (66.7%)	p=0.81	1	0
Hyperglycaemia ≥12.1	13154 (28%)	11012 (29.21%)	p=0.0001	1.04	-0.04
Average CBG mmol/l	10.02	10.25	p=0.0001		

Impact (300 words maximum)

Describe the impact of the initiative(s) for inpatients with diabetes and how this was measured.

Much of the impact has been described previously. Reductions in hypoglycaemic events we believe have contributed to the 1 day reduction in length of stay. We have also found a reduction in-hospital mortality from 6.7% to 4.8% between the previously mentioned study periods (p=0.01); however, this needs to be confirmed after adjusting for co-morbidities. We are currently undertaking this analysis as well as an analysis of the health economics of the DICE project.

The success and impact of this project can also be measured by the very positive feedback we have received from patients (see user group statement), from colleagues around the country where this data has been presented and from accepted publications and abstracts. This awareness is important in supporting others to innovate for the benefit of inpatients with diabetes. The hospital trust has now fully funded the inpatient nurse team (previously soft money funded) as well as a new nurse to help develop a new initiative on perioperative diabetes care.

Adaptability, Cost and Sustainability (300 words maximum)

How easily could your initiative(s) be adapted to other hospital Trusts? Please state whether any other Trust(s) has adapted your initiative(s) and/or any steps you have taken to promote wider dissemination of your initiative(s).

Please demonstrate the sustainability of your initiative(s). Include the cost incurred and the source of funding i.e. acute trust or CCG or any other means. Describe the process by which the funding has been sought and the challenges experienced.

The Abbott Precision Web system is commercially available. As it was already in use in our trust there has been no additional cost to us. The cost to a new user is unlikely to be significantly greater than that of their current glucose systems. We have not costed the time given by the hospital's IT staff or that of Abbott Diabetes Care UK data management staff. This was provided in good will. It should be noted that there was a 19.8% reduction in blood glucose strip utilisation which may reflect the result of better control and therefore less need to retest.

It would be very easy for another trust to follow the pathways we have used to develop the link between the web based system and the hospital IT systems without significant cost.

We had a great deal of interest from other trusts in this innovation and as described in the feedback section the ground work we put in to adapt the web based system for clinical use has been of great benefit to other trusts in the MAGIC study. More recently, based on our experience, Oxford University Hospitals Trust has introduced a similar adaption of the Abbott system for alerts and audit purposes.

Learning (300 words maximum)

One of the main aims of the competition is to enable learning and sharing of initiatives for the benefit of inpatients with diabetes. Use this section to outline any learning(s) that can be taken from the initiative(s) and/or challenges faced along the way that could be transferred to other Trusts looking at introducing similar initiatives.

The most important message from our work is the importance of teamwork. All the initiatives and innovations described in this application have been achieved by having a proactive team sharing a common and valued goal, meeting regularly to share observations and experiences, thereby enabling problem solving and development of implementation strategies.

Essential to a technological based innovation such as this is having the support of local IT staff and industry staff. This can be difficult to achieve in the first place and also difficult to maintain as technical staff have so many demands on their time. For us, key to getting initial buy-in from the hospital IT staff was support of the Trust management team; to maintain involvement we ensured that these individuals were included in all relevant correspondence, invited to our regular meetings, informed of the progress of the project and included in sharing successes.

Feedback from staff and patients (300 words maximum)

Please include a summary of any patient feedback and evaluations of the initiative(s). It will be helpful if you can provide (as supporting materials) the tools used to gather this information. If available, please include summary of staff feedback to demonstrate their perspective on the initiative(s)' impact on the care of inpatients with diabetes in relation to the prevention and management of hypoglycaemia.

"The MAGIC study reinforced our ideas that inpatient hypoglycaemia is a serious and common problem. We accept that education forms one pillar of management; however we now adopt a more proactive approach. We now see patients within 24hr of an episode of

hypoglycaemia. The rationale was based on the findings of the MAGIC study, where we demonstrated that hypoglycaemia seldom occurred in isolation. With this change in practice, we demonstrated a 50% reduction in hypoglycaemic episodes”.

Dr James Young, Consultant, Worcestershire NHS Trust

“We are still reaping the benefits of the MAGIC hypo study here at NLAG”.

Caroline Andrews, DISN, Northern Lincolnshire and Goole NHS Foundation Trust

“We now use Precision X to proactively identify hypoglycaemia. Our management have requested monthly reports to feed back to individual areas to help reduce hypos”.

Beverly Eaglesfield, DISN, Derby Teaching Hospitals NHS Foundation Trust

The MAGIC study made us more aware of the problem of hypoglycaemia and as a result we have made improvement in hypo rates a local priority ...feeding back hypo rates to wards on a monthly basis. The data has allowed us to engage support from both senior nursing and management teams to help move forward our plans for improvement.

Dr Fiona Green, Consultant, NHS Dumfries and Galloway Royal Infirmary

“Following the MAGIC study, we have introduced prescribed bed time snacks for all patients with diabetes on treatment. It's cut our total number of hypos by 30%”.

Dr Francesca Swords, Consultant, Norfolk and Norwich NHS Trust

The MAGIC study has focused our minds on increasing awareness of hypoglycaemia risk and helped our case for a dedicated diabetes in-patient specialist nurse, who provides an education package on hypoglycaemia for ward staff and carries out a rolling audit of hypoglycaemic episodes.

Dr Peter Hammond, Consultant, Harrogate NHS Foundation Trust

The user group are pleased to have been involved with DICE project at various stages from its inception. We welcomed the introduction on a bed time snack and are delighted to learn of the impressive reduction in hypoglycaemia.

Garry Miller- Ambassador of the Ipswich Hospital NHS Trust, member of the Diabetes User Group

Supporting materials

The judges' core assessment of your initiative will be based on this entry form. However, we do recommend that you **support your entry** with relevant materials, as these will be made available to the judges and are often the deciding factor in short listing the finalists.

Supporting materials could include: IT based programmes, pamphlets, booklets, audits, events, reports, journal articles, evaluation documentation, websites etc.

Supporting materials along with your entry form should be submitted by email to christine.jones@nnuh.nhs.uk.

Closing date 1st September 2015

The winners of the Rowan Hillson Insulin Safety Award 2015: Best UK Inpatient Hypoglycaemia Prevention Initiative will be published on the Association of British Clinical Diabetologists (ABCD) and Diabetes UK websites and will appear and be referred to in future journal articles. By submitting your entry, you will be consenting to your initiative being used for these purposes.