

# Application of multi-professional simulation based training to support healthcare staff in the management of hypoglycaemia and diabetic ketoacidosis

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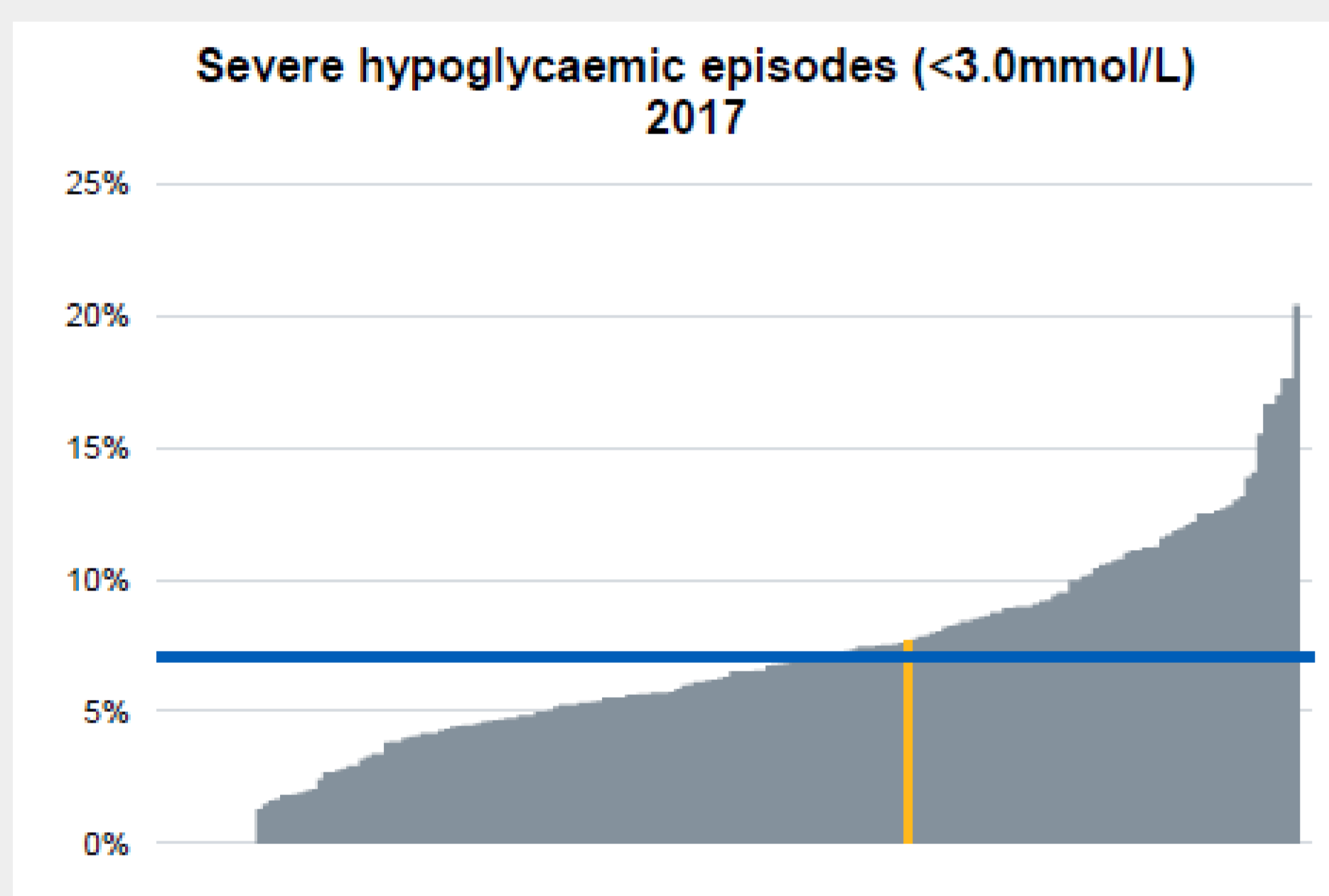
## Background

Hypoglycaemia and diabetic ketoacidosis (DKA) are diabetic emergencies with a high incidence at local and national level of severe inpatient hypoglycaemic episodes for example (figure 1). Recognition and appropriate management of these conditions is essential for patient safety.<sup>1,2</sup>

Healthcare staff report low confidence and knowledge in managing these emergencies<sup>2</sup> with interventions necessary to address these issues.

Simulation based training (SBT) is an effective educational tool that allows deliberate practice in a safe, controlled environment.<sup>3</sup> As a training modality SBT has been shown to enhance technical and non-technical skills, trainee confidence, and preparation for clinical emergencies,<sup>3,4,5</sup> with potential for application to diabetic emergencies.

Figure 1: Hospital inpatient severe hypoglycaemic episode frequency (yellow line = local frequency)



## Aims

To evaluate the use of multi-professional high-fidelity simulation to educate nurses and healthcare assistants (HCAs) on the management of hypoglycaemia and diabetic ketoacidosis.

## Design & Methodology

A half-day live actor SBT event (figure 2) including a pre-briefing, simulation event and debriefing (figure 3) was developed by a multidisciplinary team including nurses, doctors, pharmacists and educationalists.

Nurses and HCAs on two hospital wards were invited to participate. Effectiveness of the simulation on understanding of the management of hypoglycaemia and DKA was measured using ten pre- and post-test multiple choice questions (figure 4).

Surveys, using a 5-point Likert scale, were distributed to all participants to evaluate their perceived confidence pre- and post SBT and views of the session.

All data was entered into a database and analysed descriptively for agreement scores with paired t-tests used to explore change in test scores and Wilcoxon sign rank tests for change in confidence scores.

\*Ethical approval was not required as this was a service evaluation.

Figure 2: Multi-professional hypoglycaemia simulation based training scenario



Figure 3: Multi-professional simulation debrief session



Figure 4: Example multiple choice questions

Which of the following TWO insulins should be continued with an intravenous insulin infusion?

- Novomix insulin
- Apidra insulin
- Toujeo insulin
- Humulin M3 insulin
- Levemir insulin

Which of the following statements regarding hypoglycaemia are correct?

- Symptoms of hypoglycaemia typically include sweating, dry mouth and polyuria with a blood glucose <4
- Symptoms of hypoglycaemia typically include confusion, hunger, sweating and tremor with a blood glucose of <5.5
- Symptoms of hypoglycaemia typically include sweating, dry mouth and polyuria with a blood glucose of <5.5
- Symptoms of hypoglycaemia typically include sweating, dry mouth and polyuria with a blood glucose of <4
- Symptoms of hypoglycaemia typically include hunger, sweating and tremor with a blood glucose of <4

## Results

- Fifteen participants (12 nurses, 3 healthcare assistants) completed the course.
- Pre-test, mean knowledge scores were 4.6±1.88.
- Post-test, mean knowledge scores were 7.33±1.45, an improvement of 2.73(CI 1.72 to 3.75) t(14)= 5.78, p<0.0001.
- Participants reported increased confidence in the recognition and management of both hypoglycaemia and DKA (See table 1).
- Regarding the course, participants agreed that:
  - The SBT was a valuable learning experience (mean 4.6 ± 0.51).
  - That enhanced their understanding of the management of DKA (mean 4.4±0.63) and hypoglycaemia (mean 4.6±0.51).
  - They would recommend the course to colleagues (mean 4.7± 0.49).
  - They would apply their learning in clinical practice (mean 4.6 ± 0.51).
  - The SBT will help to improve the care of their patients (mean 4.7±0.49).

## Results

Table 1: Reported self-confidence of participants in managing DKA and hypoglycaemia pre- and post-SBT

Question	Pre-mean	Post-mean	Mean change	Significance
Recognising symptoms of hypoglycaemia	3.93± 0.70	4.40 ± 0.51	0.47±0.64	z=-2.33, p=0.02
Managing hypoglycaemia	3.47 ± 0.83	4.13 ± 0.74	0.67±0.72	z=-2.64, p=0.008
Recognising symptoms of DKA	2.93 ± 0.88	4.13 ± 0.52	1.20±1.01	z=-2.99, p=0.003
Managing DKA	2.93 ± 0.88	3.73 ± 0.80	0.80±0.77	z=-2.76, p=0.006

## Discussion

A high-fidelity, multi-professional live actor SBT for DKA and hypoglycaemia has been developed to support healthcare staff.

The SBT is well evaluated with significant increases in the knowledge of participants and self-reported confidence in managing DKA and hypoglycaemia.

Whilst promising, the effect of this intervention on clinical practice has not been evaluated and requires further investigation.

Additionally, this is only a pilot study with a small sample of participants. Further work is needed to determine if the results are reproducible with both a larger sample and other professions involved in the management of DKA and hypoglycaemia including doctors and pharmacists.

## Conclusion

A multidisciplinary diabetes simulation training event is valued with potential to improve knowledge of healthcare staff on hypoglycaemia and DKA management. Future studies are required to determine feasibility of the programme and any potential impact on the management and incidence of these diabetic emergencies.

## References

- Kearney T, et al. *Postgrad Med J*. 2007; 83(976): 79–86
- Kelly N., et al. *BMJ Open Diabetes Research and Care* 2015;3:
- Lloyd M., et al. *Clin Pharm* 2018;9(10)3-10.
- Salas E et al., *Hum Factors* 2008;50(6):903-933
- Sarfati L et al., *J Eval Clin Pract* 2018:1-10