



HOSPITAL-WIDE AUDIT DETECTS HIGH PREVALENCE OF DIABETES-RELATED MEDICATION ERRORS AND CLINICAL INERTIA

Endocrinology

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ABSTRACT

A point-prevalence study of inpatient diabetes management at a Melbourne metropolitan hospital detected diabetes-related medication errors in 20% (21/105) of inpatients, in addition to significant therapeutic inertia in response to adverse glycaemia. Following an initial hypoglycaemic episode, most individuals did not receive treatment adjustment, and 72% experienced recurrent hypoglycaemia. A coordinated proactive approach to inpatient diabetes care is urgently needed.

KEYWORDS

clinical inertia, diabetes control

INTRODUCTION

More than one in four individuals in hospital have diabetes¹. Hyperglycaemia in hospital is associated with adverse pathophysiological changes on the immune and cardiovascular system², leading to increased risk of hospital-acquired infections, longer length of stay and increased mortality³. Hypoglycaemia in hospital is also associated with cardiovascular stress, arrhythmia, neurological sequelae, and longer length of stay⁴. Therefore, avoiding hyperglycaemia and hypoglycaemia is paramount for safe diabetes care⁵.

Medication errors are common in hospitals and may cause harmful consequences. Patients with diabetes are at greater risk of medication errors due to the increasing complexity of available glucose-lowering medications (GLM), insulin types and insulin regimens. Insulin dose requirements are highly variable between individuals, and within individuals due to variations in nutritional intake, renal function and exacerbating factors such as glucocorticoid treatment. In addition, individuals with diabetes often have associated cardiovascular, renal and other chronic comorbidities, leading to polypharmacy. Therefore, insulin and GLM are highly susceptible to prescribing and administration errors, which could lead to hyperglycaemia and hypoglycaemia^{6,7}.

Clinical inertia, defined as the lack of appropriate adjustment to treatment despite clinical indication, is described in hospital diabetes care^{8,9}. An example of clinical inertia is a lack of initiation of insulin or escalation in insulin dose despite persistent hyperglycaemia. Similarly, a lack of de-escalation in insulin dose despite hypoglycaemia may lead to recurrent hypoglycaemia.

Recognition and elimination of medication errors and addressing clinical inertia are essential to improve the care of hospitalised individuals^{10,11}. The aim of this study was to investigate prevalence of medication errors in inpatients with diabetes, and the prevalence of clinical inertia by health professionals in an Australian healthcare system.

A single-day point-prevalence study was conducted at the three Northern Health affiliated hospital sites (The Northern Hospital, Broadmeadows Hospital and Bundoora Hospital), to identify all individuals with diabetes. All adult multiday inpatients with diabetes in non-critical care, critical care, and subacute wards were included, but individuals admitted under maternity, psychiatry, palliative care, day procedure and emergency departments were excluded. A chart review for the preceding 7 days was performed on all eligible individuals, assessing medication prescription, medication administration, and glycaemic control. Medication errors were assessed in patients who were treated with GLM or insulin prior to

admission, using the framework employed in the United Kingdom's annual National Diabetes Inpatient Audit (NaDIA)¹². To evaluate clinical inertia, adjustment to GLM or insulin regimen within 48 hours of an episode of severe hyperglycaemia (BG >15 mmol/L) and hypoglycaemia (<4 mmol/L) was assessed. This study was approved by the Melbourne Health Human Research Ethics Committee (LNR17/MH/297).

Of 351 inpatients (98% of occupied beds) surveyed, 126 (36%) had a pre-existing diagnosis of diabetes, of which 116 (92%) had type 2 diabetes, 5 (4%) had type 1 diabetes and 5 (4%) had type 3c (pancreatogenic) diabetes. Mean age was 74 years, and mean (sd) HbA1c was 7.5 (1.6)%. Fifty-one individuals (41%) were admitted in medical wards, 22 (17%) in surgical wards, and 53 (42%) in subacute wards. Prior to admission, 21 (17%) of individuals were diet-controlled, 65 (51%) were treated with GLM without insulin, and 40 (32%) were treated with insulin with or without GLM.

Of 105 individuals who were on GLM or insulin treatment prior to hospitalisation, 21 patients had 27 medication errors. Eighteen errors were found in GLM and 9 errors in insulin. Most common GLM error (50%) was prescription of an incorrect dose. Most common insulin error (44%) was an unclear dose prescribed. Medication errors were observed in 28%, 22% and 9% of medical, surgical and subacute units, respectively.

Thirty-five individuals (28%) had at least one incident of severe hyperglycaemia (BGL >15 mmol/L) with a total of 146 incidents. In 5 individuals (14%), there was no action taken in response to hyperglycaemia; in 25 individuals (72%), rapid acting supplemental scale insulin was prescribed without adjustment of scheduled GLM or insulin. In 5 individuals (14%), an appropriate adjustment to scheduled GLM or insulin treatment was made.

Eighteen individuals (14%) had at least one incident of hypoglycaemia (BGL <4 mmol/L) with a total of 38 incidents. Nursing staff escalated and notified the occurrence of hypoglycaemia to medical officers for all individuals, and appropriate treatment with carbohydrate occurred in 13 individuals (72%). However, only 5 patients (28%) had an appropriate adjustment of scheduled insulin or GLMs to prevent a subsequent hypoglycaemia. Consequently 13 out of 18 individuals (72%) had recurrent hypoglycaemia following the initial hypoglycaemic event (Figure 1).

Finally, of 14 individuals with suboptimal long-term diabetes control (HbA1c >8.5%) who were discharged home, only 4 had escalation in GLM or insulin treatment at discharge.

The point-prevalence of diabetes at our hospital network was 36%, higher than other hospitals in metropolitan Melbourne^{1,13}, a hospital in Sydney¹⁴, and most hospitals in England and Wales¹¹. Our high prevalence of diabetes reflects our catchment area in Melbourne's northern corridor characterised by high population growth, culturally diversity, and relative socio-economic disadvantage. Although, the majority of individuals with diabetes were managed with non-insulin GLMs prior to and during hospitalisation and upon discharge, insulin treatment in our cohort was higher than reported by Taylor et al¹².

We found 20% of individuals with diabetes-related medication errors over a 7-day period, lower than the mean 33% reported in the England and Wales hospitals in NaDIA in 2017¹². Surprisingly, more GLM errors were observed than insulin errors, but this may be related to the relatively low rate of scheduled insulin treatment in our cohort. Hypoglycaemia prevalence was also lower than compared to NaDIA data, which could reflect a relatively lower rate of insulin treatment.

We report significant clinical inertia with lack of appropriate treatment adjustment in response to adverse glycaemia, similar to previous reports in hospital diabetes management¹⁵. Of concern, we observed 72% of individuals had recurrent hypoglycaemia following the initial episode, where clinical inertia and a lack of treatment de-escalation is likely contributor.

At the time of the study, our hospital network did not have an electronic medical record for routine clinical care or medication prescription, hence, electronic tools to assist with inpatient diabetes care (such as prescription order set and clinical alerts) were not available. A specialised inpatient diabetes service was not available, therefore inpatient diabetes care was mostly performed by treating team medical officers. There is growing evidence that early intervention approaches to inpatient diabetes care by dedicated diabetes team members can overcome clinical inertia¹⁶ and improve glycaemic and clinical outcomes¹⁷.

CONCLUSION

This study highlights the ongoing challenges facing individuals with diabetes and the need for coordinated multi-faceted approaches to inpatient care, particularly in the face of the increasing diabetes prevalence. Sustained clinician education, deployment of electronic medical record tools, and early intervention models of care by a multidisciplinary inpatient diabetes team may decrease medication errors, decrease clinical inertia and improve the care of individuals with diabetes in hospital.

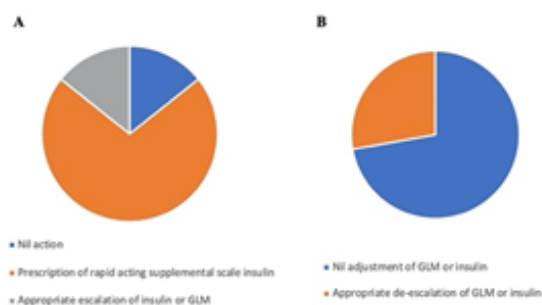


Figure 1. Health professional response to A. Severe hyperglycemia (BG > 15 mmol/L) (n=35) and B. Hypoglycaemia (BG < 4 mmol/L) (n=18).

REFERENCES:

- Bach L, Ekinici E, Engler D, Gilfillan C, Hamblin P, MacIsaac R et al. The high burden of inpatient diabetes mellitus: the Melbourne Public Hospitals Diabetes Inpatient Audit. *Medical Journal of Australia*. 2014; 201(6):334-338.
- Clement S, Braithwaite S, Magee M, Ahmann A, Smith E, Schafer R et al. Management of Diabetes and Hyperglycemia in Hospitals. *Diabetes Care*. 2004;27(2):553-591.
- Umpierrez G, Hellman R, Korytkowski M, Kosiborod M, Maynard G, Montori V et al. Management of Hyperglycemia in Hospitalized Patients in Non-Critical Care Setting: An Endocrine Society Clinical Practice Guideline. *The Journal of Clinical Endocrinology & Metabolism*. 2012;97(1):16-38.
- Turchin A, Matheny M, Shubina M, Scanlon J, Greenwood B, Pendergrass M. Hypoglycemia and Clinical Outcomes in Patients With Diabetes Hospitalized in the General Ward: Response to Ng et al. *Diabetes Care*. 2009; 32(12):e152-e152.
- Diabetes Care in the Hospital: Standards of Medical Care in Diabetes—2020. *Diabetes Care*. 2019; 43(Supplement 1):S193-S202.
- Breuker C, Abraham O, di Trapani L, Mura T, Macioce V, Boegner C et al. Patients with diabetes are at high risk of serious medication errors at hospital: Interest of clinical pharmacist intervention to improve healthcare. *European Journal of Internal Medicine*. 2017;38:38-45.

- Breuker C, Macioce V, Mura T, Audurier Y, Boegner C, Jalabert A et al. Medication errors at hospital admission and discharge in Type 1 and 2 diabetes. *Diabetic Medicine*. 2017;34(12):1742-1746.
- Correa M, Li Y, Kum H, Lawley M. Assessing the Effect of Clinical Inertia on Diabetes Outcomes: a Modelling Approach. *Journal of General Internal Medicine*. 2018;34(3):372-378.
- Pantalone K, Misra-Hebert A, Hobbs T, Ji X, Kong S, Milinovich A et al. Clinical Inertia in Type 2 Diabetes Management: Evidence From a Large, Real-World Data Set. *Diabetes Care*. 2018;41(7):e113-e114.
- Bain A, Hasan S, Babar Z. Interventions to improve insulin prescribing practice for people with diabetes in hospital: a systematic review. *Diabetic Medicine*. 2019;36(8):948-960.
- Sharma S, Rajendran R, Rayman G. Glycaemic management in patients with diabetes in hospital. *Elsevier Medicine*. 2019;47(1):40-45.
- UK D, Audit N. National Diabetes Audit [Internet]. Diabetes UK. 2021 [cited 27 March 2021]. Available from: <https://www.diabetes.org.uk/professionals/resources/national-diabetes-audit>
- Wang R, Colman PG, Kyi M, Russell N, Fourlanos S. Longitudinal prevalence of inpatient diabetes mellitus in an Australian hospital across five decades: 1972 to 2019. *Internal Medicine Journal*. 19 Sep 2020; (in press)
- Taylor J, Campbell L, Zhang L, Greenfield J. High diabetes prevalence and insulin medication errors in hospital patients. *Internal Medicine Journal*. 2018;48(12):1529-1532.
- Cook C, Castro J, Schmidt R, Gauthier S, Whitaker M, Roust L et al. Diabetes care in hospitalized noncritically ill patients: More evidence for clinical inertia and negative therapeutic momentum. *Journal of Hospital Medicine*. 2007;2(4):203-211.
- Mackey P, Boyle M, Walo P, Castro J, Cheng M, Cook C. Care Directed by a Specialty-Trained Nurse Practitioner or Physician Assistant can Overcome Clinical Inertia in Management of Inpatient Diabetes. *Endocrine Practice*. 2014;20(2):112-119.
- Kyi M, Colman P, Wright P, Reid J, Gorelik A, Galligan A et al. Early Intervention for Diabetes in Medical and Surgical Inpatients Decreases Hyperglycemia and Hospital-Acquired Infections: A Cluster Randomized Trial. *Diabetes Care*. 2019; dc182342.