

Clinical audit on in-patient diabetes care in a university medical unit

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Abstract

Introduction:

Auditing is integral to recognising deficits in care and providing sustainable improvements. Auditing of in-patient diabetes care has not been practised in Sri Lanka despite its impact on patient outcomes. The objectives were to assess the quality of in-patient diabetes care at a University Medical Unit measured against the standards in 'National diabetes in-patient audit, UK' and American Diabetes Association. This was followed by implementing changes and re-auditing, completing the clinical audit cycle.

Methods:

Data were retrieved retrospectively from medical records of in-patients with diabetes at the medical ward, University Hospital - KDU. Documentation of outpatient medications, appropriateness of blood glucose monitoring, achieved glycaemic control and medication management errors were assessed. The first cycle was conducted in August 2021, followed by remedial measures, including educating medical and nursing staff and introducing hypoglycaemia and blood glucose monitoring algorithms and a structured insulin prescription form. The second cycle was conducted in July 2022.

Results:

Data were collected from 76 and 73 patient records in the first and second cycles, respectively. Outpatient medication regime was documented in 22 (28.9%) in the first cycle and 61 (83.6%) in the second cycle ($p < 0.001$). Blood glucose monitoring was inadequate in 34.2% and 57.5% in the first and second cycles, respectively. Persistent hyperglycaemia was observed in 52.6% in the first cycle and 55.7% in the second. Ten patients had hypoglycaemia during the first cycle, while four incidences occurred during the second cycle. Medication adjustment for persistent hyperglycaemia was not performed in 50% and 43.6% of patients in the first and second cycles.

Conclusion:

Unprecedented scarcity of resources during the second cycle posed limitations in glycaemic monitoring. Observed deficiencies in in-patient diabetes care that remained resistant to the remedial measures necessitate strong consideration of more proactive care improvement initiatives.

Keywords: Diabetes, In-patient, Audit, Blood glucose

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Introduction

The prevalence of diabetes is rising worldwide, creating a significant strain on the health care systems. This has resulted in increased morbidity, mortality, and increased need for in-patient care. Diabetes has been observed in more than 40% of the patients admitted to tertiary care medical units in Sri Lanka, according to available literature ^[1].

Irrespective of the indication for admission, glycaemic control is a cornerstone in managing a patient with diabetes admitted to a hospital ^[2, 3]. Knowledge of outpatient treatment regimens, adequate blood glucose monitoring, and appropriate use of oral hypoglycaemic agents and injectables are required to achieve optimum control. Since there are barriers to implementing these measures, deficits have been identified worldwide. Recognition of these deficits and underlying barriers through auditing and benchmarking would enable improved patient care.

Auditing in-patient diabetes care is a routine practice in the developed world ^[4-6]. National diabetes in-patient audit is integral to the National Diabetes audit of the United Kingdom ^[6]. This has been used across different health settings to recognise deficiencies in patient care ^[5]. It was shown that auditing had been used effectively to implement strategies for sustained improvement in care provision ^[7].

It was shown that auditing and benchmarking against evidence-based guidelines is rare in Asia ^[8]. We found several studies auditing diabetes care in outpatient settings in Sri Lanka ^[9-11]. We did not come across any publication on auditing in-patient diabetes care. Another limitation observed in most audits was the lack of re-auditing following the implementation of changes to assess the efficacy of the changes to improve standards.

The objectives of this clinical audit were to assess documentation of outpatient medication regime, appropriateness of glycaemic monitoring, glycaemic control achieved and medication management errors during the hospital stay in patients with diabetes treated at the medical ward, University Hospital, Kotelawala Defence University (UH-KDU). Description of remedial measures implemented and analysis of results of re-auditing allow critical appraisal of the efficacy of interventions in achieving desired goals. This would provide ground to develop auditing and benchmarking of in-patient diabetes care followed by careful development of strategies for improvement in other health care

institutes.

Method

This clinical audit was conducted at the medical ward, UH-KDU. Medical records of all patients with a prior diagnosis of diabetes, managed and discharged during the study period in the unit were reviewed retrospectively. Patients with newly detected hyperglycaemia during the index admission were excluded. All eligible records were included in the audit.

The first cycle of the audit was performed for two weeks in August 2021. Details of the patients' clinical status, documented drug history, blood glucose chart and medication records were retrieved using a structured data proforma to assess the degree of glycaemic monitoring and blood glucose values, including the incidence of hypoglycaemia, persistent hyperglycaemia and management of blood glucose during the hospital stay. Special attention was paid to steps taken in response to persistent hyperglycaemia and hypoglycaemia.

Since there are no local standards to assess in-patient diabetes care, standards used to define the quality of care in 'National diabetes in-patient audit, UK' ^[12] and recommendations by the American diabetes association ^[13] were used to audit the current practices.

Appropriateness of blood glucose monitoring was assessed as shown in table 1.

Satisfactory blood glucose control was assessed by considering the presence of persistent hyperglycaemia (two or more blood glucose values >200 mg/dL recorded four hours or more apart), the development of hypoglycaemia (<70 mg/dL) and using a 'good diabetes day'. A Day on which there was no more than one blood glucose measurement > 200 mg/dL and no blood glucose measurements <70 mg/dL was defined as a 'good diabetes day' provided appropriate blood glucose monitoring was performed. Records of patients with inadequate blood glucose monitoring were excluded from calculating 'good diabetes days'.

Medication management errors assessed were,

- Not increasing insulin dose/oral hypoglycaemic agents in the presence of persistent hyperglycaemia.

- Not reducing insulin/oral agents causing hypoglycaemia in the presence of unexplained hypoglycaemia.

Table 1 : Recommended blood glucose monitoring frequency for in-patients with diabetes

Patient status	Minimum blood glucose testing frequency
Metformin or sitagliptin or diet alone	Once daily
Long-stay patient on diet and metformin with stable control	Once weekly
Sulphonylurea, insulin(basal/pre-mixed twice daily)	Twice daily or more
Unwell/ unstable patients/ on the basal-bolus regime or more than twice daily insulin	Four times daily

-Use of inappropriate insulin regimes. Basal-bolus-correction regime, pre-mixed twice-daily regime and basal-only regime were considered appropriate insulin regimes.

-Not providing the scheduled insulin dose following management of hypoglycaemia.

Appropriate management of hypoglycaemia was measured according to the standards recommended by Joint British Diabetes Societies for Inpatient Care [14].

Data were entered into the Statistical package for social sciences (SPSS). Descriptive statistics were used to define performance at the study unit against the standards of care described below.

The key remedial measures implemented following the analysis of the data from the first cycle were,

- Conducting training sessions for medical and nursing staff on documentation, blood glucose monitoring and management of hypoglycaemia and hyperglycaemia

- Introduction of hypoglycaemia and blood glucose monitoring algorithms to be referred in the ward

- Introduction of a structured insulin prescription form

Following the implementation of the above interventions, the second cycle was conducted in July 2022 for two weeks. Results of the care indicators for binomial and continuous variables were compared between two cycles using the two proportion z-test and z-test for two means, respectively.

Ethics approval was obtained from the Ethics review committee, Faculty of Medicine, General Sir John Kotelawala Defence University.

Results

Data from 76 and 73 patient records were collected and analysed during the first and second cycles, respectively. Characteristics of the patients included in the study are summarised in table 2. Type of diabetes and duration of diabetes were recorded only in two patients in the first cycle and five patients in the second cycle. Documentation of the outpatient medication regime has improved significantly, as shown in table 2 (<0.001).

Results of in-patient blood glucose monitoring and management care indicators are outlined in table 3. Blood glucose monitoring was appropriate according to the expected standards in 65.8% of the patient records in the first cycle. This has dropped to 42.5% during the second cycle. Three patients did not have any blood glucose measurements. Percentages on glycaemic control indicators were calculated for 70 patients in the second cycle.

In the first cycle, of the 40 patients who experienced persistent hyperglycaemia, only 20 (50%) received appropriate treatment adjustments. In the second cycle, 22/39 (56.4%) received treatment adjustment.

Twenty five patients have received insulin during the first cycle while in the hospital, and 17 of them were considered to be appropriate regimes. Insulin infusion had been used in four patients without a documented clear indication. The number of patients receiving insulin during the second cycle was 29 (39.7%), out of which 22 (75.9%) were considered appropriate. Insulin infusions were used in four

Table 2 : characteristics of patients included in the first and second cycles of the audit

Characteristics	First cycle (n=76)	Second cycle (n=73)
Mean age in years (SD)	60.7 (11.8)	62.6 (14.1)
Males (percentage)	38 (50%)	40 (54.8%)
Outpatient diabetes medications	Documented: 22 (28.9%) Metformin: 14 Sulphonylurea: 11 DPP4 inhibitors: 6 SGLT2 inhibitors: 0 Pre-mixed insulin: 5 Other insulin preparations: 0	Documented: 61 (83.6%) Metformin: 41 Sulphonylurea: 31 DPP4 inhibitors: 13 SGLT2 inhibitors: 5 Pre-mixed insulin: 15 Other insulin preparations: 1
Reason for admission	Acute coronary syndrome: 24 Infections: 18 Stroke/ TIA: 7 Hyperglycaemia: 3 Other: 24	Acute coronary syndrome: 13 Infections: 16 Stroke/ TIA: 7 Hyperglycaemia: 3 Other: 34
Mean duration of hospital in days (SD)	4.25 (3.5)	3.79 (2.5)

instances. Three were used for patients with diabetic ketoacidosis, including two who got admitted with diabetic ketoacidosis and were considered appropriate.

Out of the ten patients who developed hypoglycaemia while in the hospital during the first cycle, only one developed neuroglycopenic features suggesting severe hypoglycaemia. However, all the patients received intravenous glucose as the first line measure indicating inappropriate use of intravenous glucose in nine patients who could have been managed with oral agents. The drug regime was changed in five patients; it was not clear whether the hypoglycaemia was unexplained or not in the other five. During the second cycle, hypoglycaemia was noted only in four patients, and one of them developed neuroglycopenia. Intravenous glucose was used in all four, where it was inappropriate in three.

Discussion

Key deficits identified during the initial cycle include

poor documentation of the outpatient medication regime, inadequate monitoring of blood glucose, persistent hyperglycaemia, inappropriate management of hypoglycaemia and medication management errors, including not adjusting treatment for persistent hyperglycaemia and use of inappropriate insulin regimes.

The appropriate blood glucose monitoring frequency was observed in 65.8% during the first cycle, declining significantly to 42.5% during the second cycle. Queensland In-patient Diabetes Survey reported that appropriate monitoring was performed on 93% of the days^[4]. It is noteworthy that at the time of the second cycle, resource restrictions necessitated the prioritisation of glucometer strips for blood glucose monitoring.

According to our data, medication adjustment was performed for persistent hyperglycaemia only in about half of the patients during both cycles, suggesting a medication management error rate close to 50%. Failure to increase doses of insulin and oral hypoglycaemic agents for persistent hyperglycaemia

Table 3 : In-patient blood glucose monitoring & management care indicators in first & second cycles

Characteristics	First cycle (n=76)	Second cycle (n=73)	Significance
Mean frequency of blood glucose monitoring (SD)	2.4 (0.88)	1.9 (1.2)	0.0038
Number of patients who received appropriate blood glucose monitoring (percentage)	50 (65.8%)	31 (42.5%)	0.0042
Number of patients who experienced persistent hyperglycaemia (percentage)	40 (52.6%)	39 (55.7%)	0.92
Mean proportion of patient days with persistent hyperglycaemia (SD)	0.38 (0.42)	0.35 (0.38)	0.65
Number of patients who developed hypoglycaemia (percentage)	10 (13.2%)	4 (5.7%)	0.107
Number of patients who developed hyperglycaemic emergencies (percentage)	0 (0%)	1 (1.3%)	Not calculated
Mean proportion of 'good diabetes days' in patients with adequate blood glucose monitoring (SD)	0.61 (0.4)	0.52 (0.43)	0.347

was observed 12.1% and 9.2% times, respectively, in the National Diabetes Inpatient Audit, UK, in 2016 ^[15]. Medication management errors were observed in 19% of the patients in the Queensland study ^[4].

However, some findings are favourable compared to the developed world, though we have not met the quality indicators recommended in the standards. The mean proportion of 'good diabetes days' was 0.61 and 0.52 in our audit. According to the National Diabetes Inpatient Audit, UK, this was less than half of the patient days ^[12]. The rate was 59.4 per 100 patient days in the Queensland In-patient Diabetes Survey ^[4]. The incidence of hypoglycaemia during the hospital stay was 13.2%, while it reduced to 5.7% during the second cycle, though it was not statistically significant. In the Queensland In-patient

Diabetes Survey, the occurrence of hypoglycaemia was observed in 9.5% of the patients ^[4]. Hypoglycaemia occurred at least once in 20% of the patients in the National Diabetes Inpatient Audit, UK ^[12]. In another study rate of hypoglycaemia was 7.7% ^[2]. Undetected hyperglycaemia and hypoglycaemia due to inadequate monitoring is a possibility in our audit. However, when calculating 'good diabetes days' only the records with appropriate monitoring were considered per the standard definitions.

In a resource-poor setting like Sri Lanka, high patient turnover and high workload encountered by the staff are major challenges in achieving quality indicators. Irrespective of the reasonable performance within the resource restrictions, it was observed that there was room for improvement in the quality of care.

Documentation of the pre-admission drug regime showed marked improvement following the interventions. However, the incidence of persistent hyperglycaemia, medication management errors, including failure to adjust medications for persistent hyperglycaemia, and inappropriate insulin regime did not significantly improve following the interventions. The inadequate sample size might have influenced the results.

Care improvement initiatives always do not provide sustainable outcomes due to many reasons such as frequent staff changes, poor participation and the lack of a supportive environment hindering the implementation of suggested modifications. Most sustainable and effective implementations have been well-structured and conducted with good resource availability [16-18]. The involvement of the diabetes team and diabetes specialist nursing staff has improved the care provision in some settings [19]. Therefore, developing a multi-faceted care initiative might be important to improve the in-patient diabetes care standards in a setting like ours. Ongoing evaluation, further remedial actions and continuous re-auditing will help to overcome the inertia.

Several limitations in this clinical audit should be considered in interpreting the available data and conducting in-patient diabetes audits in local settings. We have not assessed some important aspects such as prescription errors, in-patient diabetes foot assessment, management, and patient experience with in-patient diabetes care. These areas also should be measured in future clinical audits. The lack of local standards for in-patient diabetes care led to the adaptation of standards from international literature to measure the current practices. Development of local standards would make more realistic and achievable goals within the available resources. Both audit cycles were conducted for a short period within a single unit, making the sample size small. This might have limited the recognition of slight changes in care and rare events including in-patient occurrence of hypoglycaemic and hyperglycaemic emergencies.

However, a notable strength in this audit report includes reporting the data from two cycles with comparisons, enabling the readers to critically analyse the outcome of interventions and plan future clinical audits and initiatives to enhance the quality of care. We also have used objective and globally accepted quality indicators, allowing easy comparison with global standards. As the first ever reported in-patient diabetes audit in Sri Lanka, this

should be considered a trigger to develop larger multi-centre in-patient diabetes audits using Sri Lankan standards to improve care across the country.

Conclusions

While inadequate glucose monitoring was due to an unprecedented scarcity of resources, high rates of medication management errors without improvement call for early action within the available resources. Though persistent hyperglycaemia and incidence of hypoglycaemia show room for improvement, there is satisfactory performance within the resource restraints compared to global data.

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